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OF THE

ROYAL AGRICULTURAL SOCIETY

OF ENGLAND.

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PRACTICE WITH SCIENCE.

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EXTRACT FROM THE SOCIETY'S BY-LAWS

(Dating from the Foundation of the Society):—

"The Society will not be responsible for the accuracy of the statements or conclusions contained in the several papers in the Journal, the authors themselves being solely responsible."

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Binding of the Volumes of the Journal.

GOVERNORS, MEMBERS, and others who desire to have their copies of the Journal bou in green cloth to match the Bound Volumes issued by the Society from 1901 to 19 are requested to communicate on the subject with the Society's printers, Messrs. JAM TRUSCOTT & SON, LTD., of Suffolk Lane, Cannon Street, London, E.C.

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To avoid confusion the Volumes of the Journal have been re-numbered from the l ginning, and the following Table shows both the Old and the New Numbers of each of t Volumes which have been issued since the first appearance of the Journal in 1839:—

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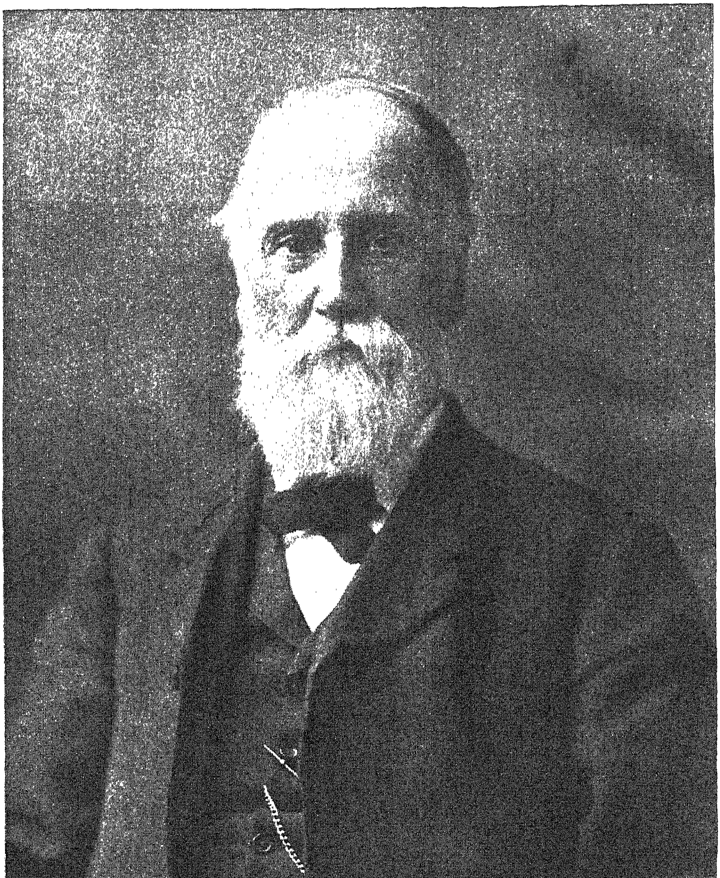
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William Carruthers

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY

OF ENGLAND.

Mr. WILLIAM CARRUTHERS, Ph.D., F.R.S., F.L.S., F.G.S., &c.

Introduction by CHAS. COLTMAN ROGERS,
Chairman of the Botanical and Zoological Committee, R.A.S.E.

A VERY unanimous wish has been expressed, on the part of many intimately concerned, that the retirement of Mr. Carruthers from the post of Consulting Botanist to the Society should not pass by unnoticed. His long connection with the Society, the services he has rendered to the members and the cause for which he has so successfully laboured, all led to a ready acceptance of the Botanical Committee's recommendation to the Council that an account of his work should be put on record, and that in addition to this, his photograph should appear in the current number of this Journal together with a memoir of his career. In compliance with the opinions thus expressed, the subjoined Memoirs have been submitted, and by request I preface their publication with a brief introduction.

Mr. Carruthers has supplied a *resumé* of the work done during his long period of office, and matter of the highest interest will be found in this narration. It very clearly demonstrates that the scientific side, so emphatically set out in the Royal Charter among the primary aims and objects of this Society, has not been lost to view.

The Society's Consulting Botanist has not only to patiently instil knowledge into those more at home on the practical than on the scientific side of agriculture, but has to compete intellectually with professional men who spend their whole

lives in an atmosphere of investigation and research. These ordeals demand weight of intellect and a certain supremacy of character before allowing the Consulting Botanist to succeed, and this is what Mr. Carruthers has accomplished.

Perhaps I may be allowed to refer to an incident that gave an opening for a tribute of esteem to Mr. Carruthers' characteristic abilities in these particular directions.

It fell to me, in company with Mr. Adeane, to meet this year, at the Royal Agricultural Show at Gloucester, many prominent members of the seed trade, our mission being to consult with them on the question of appointing Mr. Carruthers' successor; our wish, let me add, being to do nothing, regarding this appointment, that might alienate them from our Society.

Our interview with an influential deputation left us firmly convinced on two points: first, that they were strongly of opinion that the Royal Agricultural Society could not afford to offer this appointment to any one other than the highest and most undisputed authority obtainable; secondly, they were unanimous in saying that Mr. Carruthers had filled his post to their entire satisfaction.

I do not think that a higher tribute than this could possibly be placed to the credit of any man in Mr. Carruthers' position and at this particular moment of his life.

While writing, as I have been asked to do, these few lines, I am fully sensible that it would have had a greater effect to get an introduction written by Sir Charles Whitehead, under whose auspices—in conjunction with Mr. Welby—the scheme for a Consulting Botanist for the Society was adopted, or that a few words from Mr. Vincent Wheeler, my predecessor in the Chair of the Botanical Committee, would have been more effective than any efforts of mine in this direction.

Yet I can speak from the experience of some twelve years' attendance at these Committees. During that time, I may further add, I have corresponded and consulted with Mr. Carruthers. I have, moreover, enjoyed the privilege of his society at the Natural History Museum, where many results of his research and handiwork are daily viewed by the visitors. Let me, in full recollection of these experiences, write down, in willing testimony, my impressions of his unvarying courtesy and manifest desire to give information when information was sought.

In conclusion, we wish him cordially "ad multos annos" the happy prolongation of his well-earned rest.

Trusting that in his new position as an Honorary Member he may, if only occasionally, look in upon us and revisit those scenes which are so familiar to him, but which, without his

presence, will be so unfamiliar to some of us, we bid him "au revoir."

William Carruthers, for nearly forty years Consulting Botanist to the Society, was born in Moffat, Dumfriesshire, on May 29, 1830. Educated at Moffat Academy, he proceeded in 1845 to Edinburgh University. His University course, being interrupted by two periods during which he held tutorial posts, was not completed till the spring of 1854. In the autumn of that year he went to the New College, Edinburgh, to study there with a view to entering the ministry of the Presbyterian Church. Under Dr. John Fleming, the Professor of Natural Science, a naturalist of conspicuous attainments, the bent which Mr. Carruthers had already shown for science was strongly developed. Prof. Fleming, who was an old man, advised him to devote his energies to science, with a view to becoming his colleague and successor, and he accordingly studied in the University under Goodsir, Allman, and Balfour; but in 1858, before Mr. Carruthers' curriculum was finished, Prof. Fleming died, and it was out of the question to appoint a student to the chair. It is interesting to note that forty-five years later Mr. Carruthers filled this chair for a year during a vacancy.

His first position after leaving the New College was that of Lecturer on Botany in the New Veterinary College, Edinburgh. A few months later he became Assistant to the Secretary of the Royal Society of Edinburgh, and in this capacity made the acquaintance of Dr. Robert Chambers, the publisher, which led later to his contributing the geological articles in the first edition of *Chambers' Encyclopædia.* His earliest scientific paper (out of a total of seventy-two recorded in the Royal Society's Catalogue) was a geological one, on the graptolites found in the rocks of his native county, published in the Transactions of the Royal Physical Society of Edinburgh.

In 1859 he was offered, through Prof. J. Hutton Balfour, the post of Assistant in the Department of Botany in the British Museum, and took up his duties there in August of that year, the whole staff of the department at that time consisting of his chief (Mr. John Joseph Bennett) and himself. He thus definitely abandoned the Church as a profession, and devoted himself to science; but it was from no lack of sympathy with the Church. Throughout his life his great hobby has been church history and theological literature.

In 1871 Mr. Bennett retired, and Mr. Carruthers succeeded him as Keeper of Botany. His love of geology had led him to devote much attention to fossil plants, and at this time he completed a study of the structure of fossil cycads, whose

publication in the Transactions of the Linnean Society helped to secure for him the coveted distinction of the Fellowship of the Royal Society in 1871. At this time he began his work for the Royal Agricultural Society. He himself gives an interesting summary of that work in the pages which follow this notice, so it is unnecessary to say more of it here, save to emphasise the fact that he was absolutely a pioneer in this work in England.

Immediately after his appointment as Keeper of Botany the very existence of his Department was threatened; but his evidence before the Royal Commission on Scientific Instruction made so clear a case for the existence of the botanical collections alongside the other natural history collections, and showed so excellent a record for the Department, as to fully justify and firmly secure its continuance. In all the Departments of the British Museum, and in none more than that of Botany, want of space was seriously hampering the work, and when the removal to South Kensington was accomplished in 1880 the work of rearranging both the public exhibits and the collections for the use of students owed much to Mr. Carruthers' talent for organisation. In the labelling of the public collections, moreover, he was one of the pioneers of the system of giving adequate explanations on the labels, thus making the collections far more interesting and instructive to the person of average education. The removal to South Kensington necessitated the formation of a departmental library, and for some years Mr. Carruthers was very busy at this work. He ultimately had cause to be proud of having got together the finest botanical library in the world, and at the date of his retirement in 1895 his knowledge of the literature of botany was probably unsurpassed.

In 1884 he took a long trip in America (in company with the late Mr. Charles de Laune Faunce de Laune and Mr. F. S. W. Cornwallis), in the course of which he secured interesting specimens for his department, and got into closer touch with museums and herbaria on the American continent. He and his fellow travellers also gathered much valuable experience in agricultural botany on this trip.

In 1886 he was President of the Biological Section of the British Association, at its Birmingham meeting, and there delivered an address on the persistence of specific characters in plants, which presented so difficult a problem to the supporters of the Darwinian theory that it remains unanswered to this day.

In 1887 he was chosen to be President of the Linnean Society, for the period in which its centenary celebrations would fall; and for organising and carrying through these

celebrations he received the Society's thanks. In 1907 Mr. Carruthers was sent by this Society to Sweden as its representative at the bi-centenary commemorations of the birth of Linné, and at that time the ancient University of Upsala conferred on him the honorary degrees of M.A. and Ph.D. He had also been elected President of the Geologists' Association in 1875 and of the Royal Microscopical Society in 1901.

His care in attention to detail, without losing sight of salient points, his power of lucid exposition of a subject, and his willingness to satisfy any genuine desire for knowledge have made him a most useful officer both to the British Museum and to the Royal Agricultural Society of England.

S. W. C.

The Botanist's Work, 1871–1909.

In 1871 no provision existed in England for the farmers ascertaining the quality of seeds supplied to them, or obtaining the advice of a botanist in other matters that might be of service. The Council of the Royal Agricultural Society requested me to furnish it with a statement regarding the ways in which a botanist might assist the farmer. Having considered the statement prepared, the Council resolved to secure the services of a botanist and invited me to undertake the work. With the permission of the trustees of the British Museum I accepted the invitation and entered on my work in 1871, under the direction of the newly formed Botanical Committee, whose chairman was Mr. W. E. Welby, M.P. Shortly afterwards Mr. (now Sir) Charles Whitehead succeeded him and occupied the chair for many years. A small salary was fixed upon for the botanist, with somewhat large fees for consultation. These prevented the members of the Society consulting the Botanist to any great extent. A few years later the salary was increased and the fees reduced to a nominal sum, a change which brought many more applications.

Quality of Farm Seeds.

The first matter to which the Committee gave its attention was the quality of the seeds supplied to the farmer for his crops. The investigations made by the Botanist showed that the quality of seeds for pastures was most unsatisfactory. Scarcely one sample of meadow fescue examined was free from rye-grass, a much cheaper seed, which often amounted to more than half of the sample. Other deliberate adulterations, for the dealer's gain, were common, but they were not introduced by or known to the local merchants in county towns who supplied the farmer. The germination was so low that some samples examined germinated less than 10 per cent. This

was no doubt due, to some extent, to carrying over seeds from year to year until they were dead. Experiments were made with the view of determining the limit of the vitality of seeds; and to determine this with greater accuracy samples of thirty-five different kinds of farm seeds harvested in 1895 were obtained from trustworthy sources. These have been tested year after year. The progress of the experiment has been exhibited on a large diagram at the annual shows of the Society in recent years. The only seeds that germinated this year were those of a black Tartarian oat. The coming spring will probably finish the trials. A report will then be submitted to the Committee.

Purity and Germination.

In 1882, after considering the state of the seed market, the Committee published a recommendation that members of the Society should obtain a guarantee that seeds purchased contained less that 5 per cent. of impurities, and that the different kinds possessed a specified minimum germination. What was sold as foxtail, was, as a rule, collected before the seed had been formed, and consisted of nothing more than empty chaff. The Committee could not at that time fix for this grass a higher minimum than 20 per cent. For cereals, green crops, clovers, and timothy 90 per cent. was fixed, and for the other grasses 70 per cent.

Improvement of Seeds.

This step had a remarkable effect in improving the quality of seeds. In the following year, 1883, two leading firms, influenced by the action of the Society, offered in their catalogues seeds guaranteed both as to purity and germination. Through their efforts to improve the quality of their seeds they were then able to offer, at ordinary market prices, seeds of foxtail germinating 60 and 70 per cent., and other grasses of much higher quality than the Committee suggested. Other seed merchants followed, so that the guaranteeing of seeds is now nearly universal in the leading firms. His Majesty's Office of Works gave a great impetus to this effort for securing good seeds by scheduling the quality required in seeds for laying down pastures in the Royal Parks, and offering a proportional increase in price for higher germination than that scheduled. This was done on the advice of the Botanist of the Society, whose report on the seeds governed the purchase and the price paid. This method has in later years been adopted by the London Asylums Committee for their fields, lawns, and kitchen gardens, and also by several members of the Society. The change for the benefit of the farmer resulting directly from this work of the Society will be

apparent if we note the germination of pure seeds guaranteed in the catalogue of one of the first firms to offer guaranteed seeds. Foxtail is guaranteed 80 per cent. and with it wood- and rough-stalked meadow grasses, while in all the others the guarantee is from 90 to 99 per cent. It is impossible to estimate the financial gain to the farmers of England which has resulted from this action of the Society. But it is distressing that so very large a proportion of farmers still cling to their old and wasteful methods of purchase.

Two Kinds of Seed Merchants.

We must distinguish in speaking of seed merchants, between one who knows what he is dealing in, and another who only retails seeds that have been supplied to him under certain names. The latter does nothing whatever to raise the standard of his seed. The former knows the characteristics of each kind of seed, and the impurities that are present; he has appliances for removing these impurities and for testing the germination of the pure seeds. The improved quality of the seed is due entirely to his effort. In 1895 an attempt was made to ascertain the quality of seeds sold in market towns, where the irresponsible retailer chiefly carries on his business. By the kindness of members of the Society small parcels of seeds were obtained from such towns. The results of their examination were published in the Journal of the Society for 1896. There were some good seeds among them, but the great majority were inferior. Two bad samples may be quoted, to show the great loss that befalls the farmer who purchases seeds without a guarantee of purity and germination. In a merchant's catalogue for 1895 the seeds of foxtail guaranteed to germinate 85 per cent. cost 1*s.* 6*d.* per pound. To secure that one pound of germinating seeds should be sown, it is necessary to add to the pound (composed of 85 per cent. good seeds, and 15 per cent. worthless chaff) 2·8 ounces of the same bulk, to supply the lacking 15 per cent. of good seeds. This makes the price of one pound of germinating seed 1*s.* 9*d.* A farmer the same year bought seeds of the same grass at 1*s.* 2*d.* per pound, but the germination was only 6 per cent. so that 16⅔ pounds had to be purchased to obtain one pound of germinating seeds, and for this the farmer would have had to pay 19*s.* 6*d.* The same merchant in his catalogue offered one pound of germinating seeds of rough-stalked meadow grass for 1*s.* 6*d.*, while the farmer would have had to pay 7*s.* 9¼*d.* to his country merchant for the same quantity of germinating seeds.

Condition of Seed Trade in Ireland.

The investigation in 1894 and 1895 of a large series of farm seeds purchased in various localities in Ireland on behalf of

the Irish Land Commission by the Society's Botanist exhibited a worse condition in the seed trade in Ireland than existed in England, and resulted in the establishment, in connection with a Government Department, of a seed station in Dublin.

Seeds for Pasture.

The Committee next dealt with forming new and improving old pastures. The universal experience was that after the second or third year new pastures began to fail. It had been the practice—a practice still prevalent—to purchase mixtures prepared by the merchants for different geological formations, and composed of a considerable variety of grasses and other plants. The farmer bought so many pounds per acre of the mixture. There appeared in the first year a good crop of fine grass, which maintained itself for a second year, and thereafter began to fail. The chief ingredient in these mixtures was rye-grass—the so-called perennial and the shorter-lived Italian.

Good Pasture Grasses.

In dealing with this problem it was important to find out what plants were palatable to the stock. No matter how well they looked to the farmer, if they were not eaten they were of no value in the pasture. The grasses and other plants which flower and seed in a well-fed pasture afford the farmer obvious evidence as to the plants which are not palatable to his stock. These have been rejected in the grazing. Some care must be taken in observing the treatment of the pasture by animals. A cautious and experienced agriculturist ascribed the high feeding value of a pasture in Herefordshire to the rye-grass which was manifest everywhere in the field. He hurdled in a portion, and immediately the unobserved cocksfoot, meadow fescue, and foxtail sprang up. He concluded that the "coarse" grasses were deleterious because they smothered the finer rye-grass, but afterwards he found that these coarse grasses were the valuable elements in the pasture, and had been eaten so closely down by the stock that they escaped his notice. The cattle had fattened on them and neglected the rye-grass. Next, to find which of these supplied the largest amount of nutriment, and finally what grasses and other plants maintained their hold on the ground, that is, were perennial. The famous pastures of England were inspected and reported upon, careful observations were made as to the selection or rejection of the different plants in the pastures, and experiments were carried on at the Society's farm at Woburn with separate plots of grasses and clovers. The committee were greatly aided in these matters by the observations and experiments of the late C. De

L. Faunce De Laune, of Sharsted Court, carried on with the assistance of the Society's Botanist. His views were clearly expressed in an important memoir published in the Society's Journal in 1882. It is not possible to speak too highly of the value of his researches to the Society and to the farmers of England. The result of all these observations, added to the experiments of Swayne, Curtis, Thornhill, and Sinclair, was to get rid of many worthless and second-rate grasses, and to limit the kinds of grasses used to those that were palatable, nutritious, and perennial. These essential grasses were found to be cocksfoot, meadow fescue, foxtail, timothy, and one or two meadow grasses (*Poa*), with white clover and red, but unhappily the only perennial red clover, though a native of Britain—the true "cowgrass" (*Trifolium medium* Linn.)—cannot yet be obtained in quantity sufficient for the use of the farmer. Pastures have been laid down with these grasses and clovers, in due proportions, which have prospered for years without any decline, supplying palatable and nutritious food for all kinds of stock, on all varieties of geological formations. The cost of laying down has been reduced, and with the good and pure seeds that can now be procured the problem of producing a new, good, and permanent pasture has been solved.

Great Merits of Timothy.

An important result of the experiments carried on at Woburn in 1887-1888 has not received the attention it deserves from farmers. These demonstrated the greater value of timothy over rye-grass for short lays. The feeding value of timothy is at least equal to that of rye-grass. It is certainly palatable to stock. Some years ago the General Omnibus Company sought the advice of the Society's Botanist as to the Canadian hay it had purchased to make up for shortage in the home crop. Timothy is the hay grass of Canada, and it was the only grass in the hay purchased. Their large stud was fed on it for several months; it proved to be a palatable and nutritious food. The green produce at Woburn for the two years named was at the rate of 6 tons 13 cwt. per acre for timothy, while perennial rye-grass yielded 5 tons 11¼ cwt., and Italian 5 tons 17¼ cwt., the same number of germinating seeds per acre being sown in each case. Timothy is without any doubt a perennial grass. It is also the cheapest good grass in the market. This does not mean that timothy costs less per lb., but that for the same money one can buy sufficient seeds to produce a larger number of plants than can be obtained in the case of any other useful grass. From this point of view rye-grass is a costly seed. The relative price of the seeds, as plant producers, will be obvious if the cost of laying down an acre with a single kind of grass is

considered. Suppose ten million plants to be sufficient for an acre, the cost per acre would come out thus:—

	Cost	Seed for 10,000,000 plants	Cost
	Per lb. s. d.	lb.	Per acre s. d.
Timothy	0 $4\frac{1}{2}$	8	3 0
Rough-stalked meadow grass	1 8	5	8 4
Italian rye-grass . . .	0 $3\frac{3}{4}$	40	12 6
Perennial rye-grass . .	0 $3\frac{1}{2}$	46	13 5

It would clearly be a gain to the farmer in every way to substitute timothy for rye-grass both in his annual and biennial lays, as well as in his permanent pasture.

Improving Existing Pastures.

In association with my colleague, Dr. Voelcker, numerous experiments have been made throughout England with the view of improving the herbage of parks and old pastures. The results have been set out in several joint reports, and suggestions have been made of great practical value to the farmer.

Pasture Weeds.

Many contributions have been published on the weeds of pastures and cultivated lands. The different methods of treating biennial and perennial weeds, and the difficulty of eradicating those with underground creeping stems or roots, have been pointed out. It has been established that yarrow should have a place in all mixtures for laying down permanent pastures, not because it has great nutritional value, but because stock like it and eat it down in all well-fed pastures. All other weeds should be extirpated, as they are rejected by stock and reduce the value of the pasture, even when they are not really dangerous. Records have been given in the Journal, as they occurred, of cases of poisoning in horses, cattle, and sheep by unsuspected weeds. A complete illustrated review by the botanical assistant, Mr. H. T. Güssow, of the poisonous plants which are natives of England was published in the Journal, Vol. 68, 1907.

Diseases of Plants.

An important part of the work of the Botanist, which was hardly anticipated at the time of his appointment, but has steadily and largely increased in recent years, has been the investigation of injuries to plants.

Some injuries are due to physical causes, such as excessive or insufficient moisture, severe cold, lightning, and furnace fumes. In the specimens submitted these causes were explained and suggestions given for treatment.

Parasitism of Flowering Plants.

The majority of injuries are caused by the attacks of other plants, which obtain the whole or part of their food as parasites. Dodder and broom-rape feed entirely on clover and ultimately destroy it. The mistletoe also gets all its food from the trees on which it grows. Yellow rattle and eyebright obtain part of their food from the roots of the host-plant, but at the same time they manufacture a part of their food in their green leaves, which are absent in the other parasites named. These have been described and figured in the Journal, and methods of treatment have been given.

Parasitism of Fungi.

The greater number of diseases affecting plants, and the most serious, are caused by parasitic fungi. These have been investigated, and many have been cultivated in the laboratory to obtain the characters by which they are distinguished. Information has been given to members of the Society, and in many cases published in the Journal, about attacks on forest trees, as the canker in larch, injuries to oak, beech, and other trees; attacks on orchard trees, like the serious one on the Kent cherry trees, the different diseases of apples, pears, plums, &c., the American blight of the gooseberry, and the diseases attacking fruit trees in houses, also cucumbers and tomatoes. The chief work, however, has been with farm crops. The various maladies that injure cereals and grasses have been investigated and fully described. The so-called "clover sickness" was traced to its cause, and the result published in the annual reports, and more exhaustively in a separate memoir by Mr. H. T. Güssow, laboratory assistant, published in the Journal for 1903, page 376. The various maladies of the potato have received much attention. In connection with the prize offered in 1874 for disease-proof potatoes by the late Lord Cathcart, when President of the Society, the Botanist visited the twenty localities in Britain and Ireland where the tests were made, and prepared a report upon these trials and the result of the competition. A wall diagram of the potato disease, showing its different stages, with descriptive letterpress and suggestions for dealing with it, was published by the Society, and copies were freely distributed throughout Ireland by the Land Commission. Several other diseases attacking the potato have been investigated, and descriptions and illustrations

have been published by the Society. Hitherto unobserved maladies affecting mangolds and turnips have been described and figured. These and many other investigations have appeared in the Journal of the Society.

Information has been asked for and supplied to the following Government institutions: The Royal Agricultural Society of Germany, the Departments of Agriculture of the United States, of the Argentine Republic, and of the Government of Brazil. And at home continuous help has been given to H.M. Office of Works, the Irish Land Commission, and the London County Council's Asylums Committee.

The work of these years has often been tedious and troublesome, but throughout it all I have been helped and encouraged by the Committee whom I served. The minute organisms causing injury to plants—bacteria and fungi—require in their investigation sharp and clear eyesight, and this my advancing years have seriously affected. I have had for more than twenty years able assistants in my laboratory, without whose help I could not have carried on my work. One of these is now Assistant Director of Agriculture to the Government of Trinidad, and another is Botanist to the Government Department of Agriculture in Canada.

It is a great satisfaction to me in retiring from my work that the practical application of science to agriculture has been of service to the farmers of England, and that work begun by the Society almost forty years ago is now being carried on in various laboratories in this country, among which the new one at Cambridge University, where the Society's work will in future be done, takes a leading place.

WILLIAM CARRUTHERS.

SOME SECONDARY ACTIONS OF MANURES UPON THE SOIL.

BY A. D. HALL, M.A., F.R.S.

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THE early volumes of the Journal of the Royal Agricultural Society from 1840 to about 1856 contain a mass of good writing which provides excellent reading even to-day, and is not likely to be equalled in any future agricultural publication. Not only was farming prosperous at that time, but it was making improvements and breaking fresh ground in all directions, new information was being acquired on both the scientific and the practical side, the resources of science and mechanics were

being brought to the service of agriculture; above all things, both the leaders and the workers had abundant faith in the value of knowledge and in the future of their industry which, at the same time, was blessed by a number of men who could write vividly upon their work. It is not my purpose, however, to discuss the writings of Philip Pusey, Daubeny, Buckman, Morton, Curtis, C. S. Read, and others, which illuminate those early volumes, but to call attention once again to one of the most interesting of all of the papers therein contained, a paper by J. T. Way on the power of soils to absorb manure (First Series, Vol. xi., 1850, p. 313), which is one of the classics of agricultural science.

Way, it should be remembered, was the second Chemist appointed by the Society, succeeding Lyon Playfair, afterwards Lord Playfair, in 1847; he did much valuable pioneer work in agricultural chemistry up to the time of his resignation in 1857, whereupon the late Dr. A. Voelcker was appointed to the post which is still held by his son. Way's work on the absorption of manures by the soil arose out of some observations by a Mr. H. S. Thompson which are set out in an earlier paper in the same volume; he found that if liquid manure was filtered through a layer of ordinary soil it appeared as a clear and inoffensive liquid, from which all the organic and ammoniacal compounds had been withdrawn. Even pure ammonium salts are equally taken away from their solutions when they are filtered through soil, and it was this class of action which Way investigated in detail, the results being set out in the paper quoted and in a second one in the Journal two years later, and again in some further papers in which Dr. Voelcker continued Way's studies after the resignation of the latter chemist. Now from the practical point of view, the important thing that Way discovered was the fact that nearly all the soluble fertilisers, the use of which was then becoming general, could be applied to the soil without any risk of their washing out, because they immediately became precipitated or otherwise fixed in the soil. Nitrates are not retained but sulphate and other salts of ammonia enter into some combination with the soil constituents which withdraws the ammonia from solution, though the acid part passes on into the drains or the subsoil in combination with lime or a similar base; soluble phosphates like superphosphate are immediately precipitated, while soluble potash salts are taken out of solution by a reaction akin to that which retains the ammonium salts. Since that time the work has been extended and completed in various directions and we now know that on ordinary land we need not fear the loss of any fertilising constituents, except of nitrates and the compounds of nitrogen which rapidly change into nitrates.

However, these facts had been unknown until Way's paper, and manure makers had even been to some trouble to render insoluble the fertilisers they were selling, lest losses by drainage should ensue. For example Liebig, as an outcome of his theory that the proper manure for any crop is a mixture of the mineral and ash constituents contained in that crop, had made up prescriptions and given his countenance to the sale of a set of Liebig's manures, fertilisers in which the constituents—phosphates and sulphates of soda, potash, lime and magnesia—were actually fused up with silica into a sort of glass in order to render them insoluble, the fused mass being afterwards ground to a powder for distribution.

Now Liebig's manures had proved failures in practice, really because of their lack of nitrogen—that most important of manure constitutents which Liebig persisted in regarding as supplied in sufficient quantities for the needs of the plant by the rain or the atmosphere—but on reading Way's paper Liebig thought that the cause of their failure must have been the very insolubility he had made such efforts to attain. A letter of Liebig's exists in which he tells Way that his paper has cleared up for him the cause of one of the greatest disappointments he had experienced—the failure of his manures in practice; the best work of his life had been given to the chemistry of agriculture, and he had missed the proper recognition of his labours because of his ignorance of this one fact which Way had at last brought to light.

In Way's paper he fixed upon the double silicates in the soil—the so-called zeolites—as the agencies causing the absorption of both ammonia and potash salts, though he also showed that humus must have an effect in the same direction, because of the great absorptive powers of all soils rich in humus. As regards the zeolites the action is intelligible enough; these bodies are complicated double silicates of alumina and various bases of which lime is the chief; in contact with a weak solution of a salt of ammonia, the lime and ammonia change place, an insoluble zeolite containing ammonia being formed on one side, and on the other a lime salt which goes into solution. Way himself in a later paper concluded that carbonate of lime in the soil did not intervene in the process; but in later years, as it appeared that sulphate of ammonia reduced the stock of carbonate of lime in the soil, it began to be thought that there must be a direct interaction between sulphate of ammonia and the carbonate of lime instead of the zeolites, as soon as the former was applied to the soil.

That the use of ammonium salts as manure does directly cause the removal of carbonate of lime from the soil may be learnt from a detailed examination of the amounts present in

the soils taken from the Rothamsted plots at successive dates during their history. At Rothamsted the carbonate of lime in the soil, the amount of which varies from about 2 to about 5 per cent. in different fields, is all of artificial origin; for though the "red clay with flints," the drift formation out of which has arisen the soil at Rothamsted, rests on the solid chalk rock at a depth of 10 to 15 ft. below, yet both soil and subsoil in a natural state are almost wholly lacking in carbonate of lime. Such natural soil may be found on the neighbouring Harpenden Common, which has never been cultivated nor subject to any improvements; and again on the grass land and a few of the other arable fields on the estate; in all these cases analysis shows only about one tenth per cent. of carbonate of lime in either soil or subsoil until the underlying chalk rock is reached. It is, however, on record that up to the early years of the nineteenth century it was a regular custom in Hertfordshire farming on this hill land to sink pits through the clay into the chalk, extract the chalk and spread a layer representing six to ten tons per acre over the arable land, the process being repeated at intervals of a few years. The "dells" or hollows in the fields, which represent the fallen-in pits, are evidence to-day of the old practice, and much of the friability and dryness of this heavy land, through which alone it has been possible to keep it under the plough, is due to the work thus done for the present generation of farmers during the seventeenth and eighteenth centuries or even earlier. As a consequence the surface soil of the Rothamsted arable fields now contains 2 per cent. or more of carbonate of lime, visible to some extent as tiny rounded fragments from the size of a pinhead to that of a pea, but mainly present in particles too small to be seen; the subsoil, however, contains none of this carbonate of lime, it has remained only in the layer stirred by the plough, and has never worked downwards. The old maxim that lime sinks in the soil is only true of lime on pastures, where it is buried by the slow but persistent action of earthworms bringing up mould to the surface; in arable land as the Rothamsted analyses prove the lime wastes but does not sink. The very special distribution of carbonate of lime in the Rothamsted soil affords, however, an exceptional opportunity of studying the rate at which this important soil constituent is removed by natural causes, and also of how the natural removal is decreased or accelerated by the constant use of certain artificial manures. Samples of soil from the Rothamsted plots were not taken at the very beginning of the experiments, at least none have been preserved; the earliest which are available date from 1856, and later samples, from the same Broadbalk field were taken

in 1865, 1881, 1893, and 1904. Samples from the other fields date back to 1867, 1868, and 1873, so that in four cases we can ascertain the effect of thirty years' action of the manures, a long enough period to make the change in composition perceptible in the analyses. Of course there are many sources of error in the analytical figures ; soil sampling is never a very accurate process, and in comparing samples taken at long intervals, a new error is introduced by possible changes in the consolidation of the ground. But the figures agree better than might have been expected, and the results may be regarded as accurate to within 20 per cent. or so. The following table shows the actual amounts of carbonate of lime calculated as pounds per acre in the surface soil from certain of the plots in the various Rothamsted fields at the dates given, while the last column of the table gives the average annual loss deduced from these figures :—

TABLE I.—*Loss of Carbonate of Lime from Rothamsted Soils.*

Field	Plot	Manuring	Carbonate of lime lb. per acre		
			Earliest date	1904	Average annual loss
Broadbalk 1865	3	Unmanured	110,500	90,200	800
	2b	Dunged	100,400	85,100	590
	6, 7, 8, 10	Ammonium Salts	85,300	61,800	1,100
	9	Nitrate of Soda	106,000	92,700	565
Hoos 1881	10	Unmanured	86,800	63,900	1,000[1]
	1 and 4 A	Ammonium Salts	54,300	37,500	775
	1 and 4 N	Nitrate of Soda	59,500	42,500	595
Agdell 1867		Unmanured	159,400	117,700	930
Little Hoos 1873		Unmanured	103,000	70,500	1,046

[1] Another plot more fairly comparable with the plots which follow lost at the rate of 675 lb. per acre.

It will be seen that the unmanured plots agree fairly well in showing a loss of 800–1,000 lb. of carbonate of lime per acre due to the washing action of the rain alone, or rather to the solvent action of rain water after it has become charged with carbonic acid exhaled from the roots or arising from the decay of organic matter in the soil. Of course there are many factors which might modify this figure in other soils ; it must to some extent depend on the actual amount of carbonate of lime in the soil, on the magnitude of the drainage through the soil, this being lessened with larger crops on normally manured land, and also on the proportion of carbonic acid in the soil

gases, which proportion would be increased with manured soil and larger crops. Still these are the best, indeed the only figures available to show the loss of carbonate of lime that arable land is likely to suffer, and we may now proceed to consider how far the loss is affected by the use of ammonium salts as manures. At Rothamsted a mixture of sulphate and muriate of ammonia has always been employed, and though certain minor differences may be traced in the action of the two fertilisers, in the main the two together will behave towards the soil of the plant just like sulphate of ammonia alone, though in a slightly more concentrated form. The table only gives a selection of the plots from which results are available (for details see Hall and Miller, Proc. Roy. Soc. 1907, *B. 77*, 1), but it is clear that the use of ammonium salts causes increased washing out of the carbonate of lime, in fact from the original figures we may calculate an average figure of 117 lb. of carbonate of lime removed from each 200 lb. of ammonium salt applied. This figure would indicate that the carbonate of lime removed is the chemical equivalent of the ammonium salts supplied as manure, which suggests that when they reach the soil they begin by reacting with the carbonate of lime and not with the zeolites as originally suggested by Way. However, direct experiments made to test this point (Hall and Gimingham, Trans. Chem. Soc. 1907, *91*, 677) showed that though some interaction will take place between the ammonium salts in solution and carbonate of lime, the zeolites bring about by far the greater part of the change, even when the carbonate of lime constitutes as much as 20 per cent. of the soil. Probably the carbonate of lime is brought into the action later, when the ammonia is liberated from its zeolitic compound in order to be converted into nitrate or taken up directly by the plant; the question is in any case only of technical interest since there is no doubt about the final result that the ammonium sulphate behaves like an acid and removes from the soil whatever amount of carbonate of lime is required to combine with the sulphuric acid it contains.

So far the matter of the wastage of carbonate of lime is clear enough, but another problem was set up when Dr. J. A. Voelcker observed that the soil of the permanent wheat and barley plots at Woburn which had been receiving ammonium salts for about twenty years had become actually acid to litmus paper (see this Journal, 1899, *60*, 515, and 1901, *62*, 286). The acidity thus developed rendered the land unable to carry barley, though its capacity to do so was restored by a comparatively small dressing of two tons of lime to the acre. Naturally acid soils had been known before, chiefly in peaty waterlogged areas, but this was the first example recorded of

a soil becoming acid through a particular course of treatment. That the acidity had developed upon the Woburn plots and not at Rothamsted where the same manuring had been continued for even longer periods, was obviously due to the fact that the soil at Woburn contained practically no carbonate of lime at the beginning of the experiments. Analyses show less than one-tenth per cent., and even this minute proportion may be largely over-estimated, because there is evidence that the organic matter in these acid soils always splits up on treatment with acid and yields some carbon dioxide which would be reckoned as carbonate of lime in the process of analysis adopted. Thus in the Woburn soil there is no base present to maintain the neutrality should any agency arise to produce acid, whereas in the Rothamsted arable soils, as we have seen, there has always been sufficient carbonate of lime to keep up a neutral condition and put out of action any acid as fast as it was produced. However, it was observed later that one of the Rothamsted fields did contain plots on which the soils had become acid through the application of ammonium salts year after year for a long period; this was the Park grass field which is cut for hay every year. Now there is no record of the Park having ever carried anything but grass, and analyses of the soil at the margins of the plots where no experimental treatment had been given showed that this was one of the pieces of land which had never received the regular chalkings to which allusion has been made earlier. The soil, therefore, of the grass plots had started with but a small proportion of carbonate of lime, an amount comparable with that present in the Woburn soil at the outset of the experiments there, and the acidity has developed itself on this soil just as it has at Woburn.

It is not clear at first sight how free acid can arise by the interaction of ammonium salts with any of the constituents of the soil; ammonium sulphate and chloride are both neutral salts in which acid and base are firmly combined at ordinary temperatures. Certain physical and chemical possibilities had been suggested, and these were first examined in some detail (see Hall and Gimingham *loc. cit.*), using clay, sand, humus, and other soil constituents separately, but without detecting any process which would give rise to free acid. On sand the ammonium salts had no action; with clay an interchange of bases between the salt and the zeolites took place as already described, but the resulting liquid remained perfectly neutral, as would indeed be expected on purely chemical grounds; with humus a similar interchange took place, also giving rise to no free acid. The humus of normal soils consists of calcium salts of the indefinite acids grouped

together as humic acid; when attacked by a solution of ammonium sulphate or chloride, calcium comes out into the solution, while an equivalent amount of ammonium goes into combination with the humic acid. Even when the mixtures of humus and ammonium salts were repeatedly evaporated to dryness in a current of air or carbon dioxide to represent in an exaggerated way conditions which might occur in the soil, no production of free acid took place. In consequence of these failures search was then made for some living agency in the soil which would set free acid from ammonium salts, and small quantities of the acid soils from the Rothamsted grass plots were introduced into nutrient solutions containing ammonium salts and organic matter. A clue was at once obtained to the actions going on in the field, for the soils were found to induce in the nutrient medium a very rapid and abundant growth of moulds and other minute fungi, the development of which was accompanied by an increasing acidity in the culture liquid. The moulds require nitrogen for their nutrition, and in order to obtain it they split up the ammonium salts and set free the acid. It was shown that the degree of acidity thus generated corresponded approximately to that prevailing in the water in the soil of the acid plots at Rothamsted soon after the application of the ammonium salts in the spring, being such as could be produced by the liberation of the acids contained in the manurial salts. The surface soil of these plots was found to be swarming with microscopic fungi, and several species were separated and identified, all of which would attack ammonium salts and liberate acids, though to a different degree. Further examination of the Rothamsted acid grass soils showed that in addition to the small quantity of acid which could be extracted by water, the amount of which was greatest in the spring soon after the application of the manures and diminished as the year progressed, there was present a much larger quantity of comparatively insoluble free humic acid. Clearly this had arisen by the action of the mineral acids, set free year by year from the ammonium salts, upon the neutral humus or calcium humate originally present in the soil, and the humic acid had been able to accumulate because it is but slightly soluble in water. Without discussing the other details bearing upon the question (see Hall, Miller and Gimingham, Proc. Roy. Soc. 1908, *B. 80*, 196), it became pretty clear that the acidity of the Rothamsted grass soils had arisen from the action of various micro-fungi upon the ammonium salts that had been annually applied to these plots; such fungi have become very abundant in the soil and are able to attack ammonium salts and set free the acid, taking

the ammonia to themselves to supply the nitrogen they require for nutrition. This explanation applies, however, only to the Rothamsted soils ; the authors have not examined the Woburn arable soils from this point of view, and indeed Dr. J. A. Voelcker has indicated certain differences in the nature of the acidity observed there. At Rothamsted the acid soils have not been rendered absolutely sterile ; the ground is still covered by herbage, but it has a very unhealthy appearance and resembles in the most interesting manner the vegetation of naturally acid soils. The grasses have a characteristic dark ugly colour and grow in tufts with bare spaces between, the surface of the ground in these bare spaces being occupied by a layer of peaty vegetable matter, as though the dead grass had been unable to decay in the normal manner. Half of each of the plots has been limed—2,000 lb. per acre of ground lime having been applied in January, 1903, and again in January, 1907. Table II. shows the great increase of crop which has followed the liming, the effect of which is also seen in the restoration of the herbage to a normal appearance and a close sward, accompanied by the disappearance of the peaty layer.

TABLE II.—*Effect of Lime upon Rothamsted Grass Plots.*

Relative yield of hay on the limed portions, the unlimed part being taken as 100.

Plot	Manuring	1903	1904	1905	1906	1907	1908	1909
4·2	400 lb. ammonium salts + super . . .	124	111	134	118	113	127	237
9	" " + complete minerals	121	110	142	128	106	118	150
11·1	600 lb. " " + " "	115	103	206	120	167	115	119

The cause of the comparative infertility of the acid soils must be set down to the fact that they are permeated by the micro-fungi which can grow in an acid medium, whereas the bacteria which normally people the soil and require a neutral medium for their growth are largely pushed out. The fungi in question compete with the higher plants like the grass for the manure applied to the soil, and being active and abundant they take so much that the crop suffers. At the same time the higher plants are doubtless injuriously affected by the suppression of many kinds of bacteria which are useful in preparing food for the crop. For example, the nitrifying bacteria, which change ammonia in the soil first into nitrites and then into nitrates, are usually regarded as necessary to the nutrition of the plant, yet are wholly inhibited by a very slightly acid medium. A number of experiments were made to ascertain if nitrification was still going on in these acid

Rothamsted soils, both by testing for the organisms which cause nitrification and by putting large samples of the soil under conditions favourable to nitrification and seeing if any nitrates were found. Small fragments of the acid soils rarely showed the presence of the organisms, but the bulk samples in all cases but one did gain some nitrates during the course of the experiment, showing that the process of nitrification was not entirely suspended. Extracts from the soil, however, refused to form nitrates even when fresh active organisms were introduced. On the whole the evidence points to the fact that a little nitrification is going on in the soils, because a few tiny fragments of carbonate of lime exist here and there and maintain a neutral condition in the soil with which they are in immediate contact. These nuclei serve to keep a limited number of the organisms still active, but in the main the process of nitrification is at a standstill and no nitrates are being produced. Now the generally received opinion is that such normal plants as constitute our crops take in their nitrogen only in the form of nitrate, so that the freedom of their growth is entirely dependent on the rate at which the nitrifying organisms in the soil first do the work of manufacturing nitrates. This is probably too hard and fast an opinion. Without doubt most plants feed on nitrates for choice and soils contain very much more nitrates than ammonia, because as fast as the latter is set free by the bacteria which split up other nitrogenous compounds in the soil into ammonia, it is seized upon by the nitrifying bacteria and converted into nitrates. But there are not wanting experiments to show that many plants, especially cereals, are capable of utilising the nitrogen of ammonium compounds directly, and later experimenters (Hutchinson and Miller, J. Agric. Sci., 1909, *3*, 179) have succeeded in growing plants with ammonium salts as the sole source of nitrogen under absolutely sterile conditions, excluding all bacteria which could change the ammonia into other compounds. Most plants, however, prefer nitrates to ammonia as their source of nitrogen, and the reduced yield on the acid soils may be partly due to the fact that the grass is driven to feed on ammonium compounds instead of the more usual nitrates. The cause of the infertility of the acid soils cannot, however, be regarded as completely established ; the absence of nitrification and the competition of the fungi for the manures are doubtless factors in the result, but they would hardly seem to account for the total failure of barley on the Woburn plots. It was surmised that the fungi might produce substances poisonous to the growth of the higher plants, but experiments to test this point have so far yielded a negative result.

The action of ammonium salts upon the soil, the investigation of which was originally started by Way and continued by Voelcker, has thus continued to afford material for research right up to the present day, and has developed in an entirely unexpected direction now that it has become necessary to regard the soil as the seat of a number of active living organisms, a point of view which had not become possible to the earlier chemists of the Society who took up the problem. The history of the investigation affords an interesting illustration of the fact that old questions have to be reconsidered with each large advance of knowledge; it also affords a notable instance of the secondary effect of a fertiliser, in this case its acid-making power, which is lost sight of under ordinary conditions but becomes the dominant feature when the experiment is pushed long enough.

Another example of these secondary actions between fertilisers and the soil which are not immediately apparent, is afforded by nitrate of soda. The relation of nitrate of soda to the plant may be regarded as the simplest possible; we know that the compound need undergo no change in order to feed the plant, it can be taken up directly and has a very immediate nutritive effect. Similarly it has but the slightest action upon the soil; nitrate of soda is not only readily soluble in water, but it does not enter into combination with any of the soil constituents, and is therefore not retained, but is washed out at once when there is any drainage through the soil. There is without doubt some interchange of bases between the soda of the manure and the other bases in the soil zeolites, because a dressing of nitrate of soda always assists the plant to obtain potash from the soil; but the nitrate part of the salt enters into no change whatever, except its absorption by plants and other organisms. Yet it is very clear that nitrate of soda has some action upon heavy soils, for all farmers upon clay recognise that the use of nitrate of soda leaves the land very wet and sticky. This is perhaps most apparent in districts where early vegetables are grown, as in the Evesham country and in Cornwall, for there the market gardeners, who are trying to push on early cabbages and broccoli to secure the earliest possible market, use quantities of nitrate of soda which seem incredible to the ordinary farmer, as much as 10 and 15 cwt. per acre. Such a dressing is apt to leave the land in a terrible state of bad tilth, from which it takes some time to recover. Some of the Rothamsted plots show exactly the same result; the bad texture of the soil, where nitrate of soda has been applied regularly in large quantities, is not perhaps so marked on the wheat field as it is on the mangold field, but there the nitrate plots are excessively wet and sticky

after rain, and dry with a hard glazed surface that marks off the plots to the eye from a considerable distance. In either wet or dry weather the nitrate plots can at once be distinguished on walking over them by their tread and feel to the sole of the foot. It is unnecessary to multiply instances, as the effect is pretty generally recognised ; usually it has been explained as due to the attraction of nitrate of soda for moisture. Nitrate of soda is always damp because of its fondness for water, and a bag of the salt left standing in an ordinary damp manure shed will sometimes be found standing in a pool of liquid, a solution formed by the water which the contents have absorbed from the atmosphere. Such an explanation of the wetness of soil dressed with nitrate of soda is entirely inadequate, because the extra quantity of water retained by the soil from such a cause would be imperceptible. Suppose as much as a ton of nitrate of soda was applied, that it absorbed its own weight of water, and again remained wholly in the surface layer of the land nine inches deep, a state of things which could only last for a short time before the crop was growing ; then because such a layer over one acre weighs just about 1,000 tons, the water retained by the whole ton of nitrate of soda would not amount to more than one in a thousand of soil, and could not cause the slightest difference to the texture. Moreover, determinations have been made of the water actually present in the Rothamsted soils on the mangold plots, and no differences that could affect the behaviour of the soil have ever been detected. The altered appearance and the greater apparent wetness must therefore be due to some other cause. Mechanical analyses were next made of the soils, *i.e.*, the soils were separated at first by sieves, and then by processes of sedimentation in water into fractions containing particles successively finer and finer in grade. The greater the proportion of fine and very fine particles a soil contains the heavier to work and the more retentive of water will it be ; true clay soils possess a considerable proportion, up to nearly half their weight, of material scientifically defined as clay and composed of particles so small as to be barely visible as units under the highest powers of the microscope. It seemed possible that the greater stickiness of the nitrated soils might be due to a general disintegration of the soil into finer particles which we might suppose could be brought about by the long continued action of the fertiliser. But it was surprising to find that the nitrated soils were distinctly and regularly coarser, that is to say, they had been deprived of some of their finer particles. Table III. gives the average mechanical analysis of five pairs of plots from the different Rothamsted fields ; in each pair there was

a plot receiving nitrate of soda to compare with one receiving ammonium salts, while the other treatment was identical on both plots.

TABLE III.—*Mechanical Analyses of Rothamsted Soils with and without Sodium Nitrate.*

Percentages after ignition.

Mean of 5 plots	No sodium nitrate	With sodium nitrate
Fine gravel	2·2	2·1
Coarse sand	6·1	6·7
Fine sand	18·8	18·8
Silt	29·5	29·9
Fine silt	14·0	13·9
Clay	17·9	15·0

It will be seen that the percentage of clay is distinctly less on the plots which had received nitrate of soda, and though the difference may not appear to be great it is without doubt a real one, because it was found to exist in each pair of soils used in the comparison (for the actual figures see Trans. Chem. Soc. 1904, *85*, 964), and it is contrary to what would have been expected from the behaviour of the soils. Of the reality of the differences we have moreover another indication in the fact that when the tile drains, which are laid beneath the whole length of the narrow strips constituting the plots on the Broadbalk wheat field, begin to run, the water flowing from the drains beneath the nitrate plots is always faintly turbid and carries a very light cloud of fine mud, whereas the water from the plots receiving ammonium salts is always crystal clear. Evidently the washing out of the finest clay particles which we see going on in the drainage water has been so continuous that the quantity remaining in the soil has been definitely reduced by the one to five per cent. shown in the different analyses. It is also evidence in the same direction to find that in the earlier years of the experiment the drain beneath the unmanured plot ran more frequently than that below the nitrate of soda plot, whereas of late years, since so much of the finest stuff has been washed out, the drains have been running more frequently beneath the nitrate plots.

The turbid aspect of the drainage water from the two sets of plots suggested another experiment, which provided the clue to the different texture of the two plots. Small equal portions of soil from the plots were weighed out, and each was shaken up with a large bulk of pure water; the resulting muddy liquids were then put to stand separately in similar tall jars. A certain time is occupied before the suspended soil

falls to the bottom of the jar and leaves the water clear above ; the finest particles of clay usually keep the water somewhat troubled for a day or two before they settle out completely. But if the settlement of soil from the unmanured plots or from the plots receiving ammonium salts was complete in two days, it would take three or four days or sometimes an indefinite time to bring about the same clearness in the jars containing soil from the nitrated plots. Now it had previously been proved that there were fewer of the finest particles in the nitrated soils, so that they should settle more quickly and more completely were there not some other factor at work hindering the precipitation.

The settlement of clay from its turbid suspensions in water has been frequently investigated, because it finds a good many practical applications in such matters as the texture of the soil, the fitness of clay for pottery and brick-making, &c., and the important facts are that acids or certain salts hasten the settlement greatly, whereas alkalis will retard or even entirely prevent it. It is well known, for example, how a little alum will bring about the clearing of turbid water, and a trace of acid or of some salt of lime will produce the same effect almost as rapidly. With suitable arrangements the process can be watched under the microscope ; as soon as the acid or salt is introduced the very fine particles, which before were moving about in the liquid without ever coalescing, suddenly rush together and flocculate or coagulate into comparatively large and heavy groups which will fall rapidly through the liquid. In clay soils that are in good tilth the very fine particles are grouped together in this flocculated condition, and the soil in consequence behaves as if it was more coarsely grained, drying more easily and into a friable condition ; whereas if the clay be knocked about or tempered when it is wet, the groups are broken up and the clay becomes deflocculated. The value of lime in improving the texture of a soil, in rendering it dryer and more workable, is due to the flocculating power of the lime salts which begin to wash through the soil ; chemical flocculation of the clay is set up and aids very greatly the mechanical flocculation which the careful cultivator attains by exposing his soil in a rough state to the wettings and dryings, frosts and thaws of the winter.

Returning to the experiment, it was pretty clear that there must be some substance in the soils from the nitrated plots which had brought them into a deflocculated condition, and this substance could not well be anything else than a trace of alkali. On testing, the soils from the nitrated plots were found to be slightly alkaline, probably with carbonate

of soda, whereupon a quantity of soil from the nitrate plot on the grass land was washed with hot water to see how much alkali could be extracted from it, this particular plot being selected because the soil contained no carbonate of lime, which itself might give rise to a soluble alkali. Table IV. shows the quantities of carbonate of soda that were found in the successive 9-inch layers down to a depth of 3 feet, the results being calculated as lb. of carbonate of soda per acre.

TABLE IV.—*Carbonate of Soda (lb. per acre) in soil of Plot 14, Park Grass Field, Rothamsted.*

1st depth 0—9 in.	2nd depth 9—18 in.	3rd depth 18—27 in.	4th depth 27—36 in.
66	37	33	39

It will be seen that the total amounts to no less than 175 lb. of carbonate of soda, which is the chemical equivalent of 280 lb. of nitrate of soda, or about one half of the yearly application (550 lb. per acre) of nitrate of soda to this plot. We cannot base our calculations on more than the year's application, because neither nitrate nor carbonate of soda are in the least retained by the soil and both must wash out pretty completely during a wet winter. The problem then was thus far cleared—it had been shown that the soils which receive nitrate of soda afterwards contain carbonate of soda equivalent to as much as one half of the nitrate applied, and this carbonate of soda was in itself enough to account for the bad texture of the soils, a bad texture which is due not to any special defect of composition but to the deflocculation of the clay particles in the soil. The next question was to account for the formation of the carbonate of soda, and here certain well established facts suggested an explanation; facts to which the late Mr. Warington had drawn particular attention in a paper contributed to the Journal of the Royal Agricultural College at Cirencester in 1899. Warington had pointed out that when the composition of any plant is examined the acids and bases do not balance one another but the acids are in excess, even though we leave out of account the vegetable acids manufactured by the plant. It is one of the fundamental conceptions of chemistry that in any compound, say phosphate of lime, there will be a definite and invariable proportion between the two components—the phosphoric acid and the lime, similarly in sulphate of lime the ratio of lime to sulphuric acid is fixed. Now taking the ash of a plant and summing the acids—phosphoric and sulphuric acid, chlorine, against the bases—potash, soda, lime, magnesia, iron, there is generally an excess of bases, but this excess is turned into a deficit as soon as we bring into account the nitrogen in the plant, which

being burnt off is not found in the ash. Yet in this connection it must be counted as an acid because it entered the plant as nitrate of lime or soda—one of the neutral salts originally present in the soil which pass into solution in the soil water and then diffuse through into the plant's roots. If then the nitrogen is calculated as nitric acid and added to the acids in the plant, it is evident that the ordinary crop must have taken from the soil a greater amount of the acids than of the bases contained in the salts presented to it as food. Table V. show this relation for four different crops at Rothamsted, the figures given for acids and bases being equivalents, *i.e.*, reductions to a common measure in which one of any acid will combine with one of any alkali, while in the last two lines the excess of base left in the soil is recalculated as lb. per acre of carbonate of soda and carbonate of lime respectively (see Hall and Miller, Proc. Roy. Soc., 1905, *B.* 77, 1).

TABLE V.—*Acids and Bases in Crops reduced to Equivalents.*

	Wheat	Barley	Swedes	Hay
Bases:				
Ferric oxide	0·03	0·04	0·09	0·17
Lime	0·36	0·46	1·24	1·03
Magnesia	0·33	0·34	0·35	0·60
Potash	0·78	0·68	1·99	2·64
Soda	0·03	0·09	0·36	0·44
Total	1·53	1·61	4·03	4·86
Acids:				
Phosphoric	0·87	0·90	1·02	1·18
Sulphuric	0·14	0·15	0·80	0·50
Chlorine	0·09	0·15	0·30	1·47
Nitrogen	3·00	2·97	6·74	5·35
Total	4·10	4·17	8·86	8·50
Excess of acid	2·57	2·56	4·83	3·62
Equivalent to carbonate of lime	129	128	242	181
Equivalent to carbonate of soda	136	135	256	192

From these results it is apparent that if the plant contains such an excess of acid it must leave behind in the soil a corresponding excess of base, because the food salts in the soil are in the main neutral compounds. At this rate the plant ought to make a medium in which it is growing progressively more basic, or alkaline if the bases set free happen to be soluble; and some of the earlier observers like Knop and Stohmann

have recorded that water cultures—*i.e.*, laboratory experiments in which a plant is made to grow without soil in water containing small quantities of the nutrient salts it requires—will become alkaline in course of time if the solution is not changed. To verify these observations various water cultures were started in which vigorous growth was maintained for some months, at the end of which time analyses were made both of the plants and of the liquid. The results all confirmed the older observations and the deductions that can be made from the composition of the crops from the field: the culture solution, which represents the soil, became more alkaline as growth proceeds (or in the majority of cases less acid, because for the success of the water culture it is desirable to start with the solution somewhat acid) and the greater the growth the greater the amount of base left in the solution. In one example, details of which are quoted in the original paper (*loc. cit.*), wheat was grown in the same jar of solution from March 3 until June 11, by which time grain was fully formed and the plants had reached the weight of 93·7 grams (about $\frac{1}{3}$ ounce); by this time the solution had acquired an excess of bases equal to about 25 per cent. of the total present, while the plant contained a corresponding excess of acids. Thus two distinct lines of evidence agreed in assigning the production of alkali in the soil to the growth of the plant itself; whenever a plant is fed with nitrate of soda some of the base will be left behind in the soil in the form of carbonate of soda. Probably the nitrate of soda does not enter the plant's roots as a whole, but a splitting up and selection takes place at the surface layer of the root-hairs, where the water and dissolved nutrients actually pass into the plant. At this layer an excess of the nitrate enters, and the soda that is rejected thereupon enters into combination with the carbonic acid which is always being excreted from the same surface layer of the roots.

Collateral evidence is also forthcoming that nitrate of soda gives rise to a free base in the soil—evidence derived from the determinations of carbonate of lime in the Rothamsted soils, to which allusion has already been made. On looking back to Table I., it will be seen that the plots receiving nitrate of soda have been losing their carbonate of lime less rapidly than the unmanured plots, one to two hundred pounds per acre per annum less, though too much reliance cannot be placed on the weights calculated. This reduction in the amount of carbonate of lime annually removed from the soil is due to the fact that the carbonate of soda formed from the nitrate of soda has done part of the work for which carbonate of lime is usually required, and has thus indirectly afforded it some protection

from waste. Both substances act alike in serving as bases for such processes as nitrification ; the carbonate of soda is a soluble base or an alkali.

Though the selective action of the plant upon the nitrate of soda is the main agency in producing carbonate of soda in the soil, a similar action is also brought about by bacteria, particularly when the nitrate of soda is present in a water-logged soil lacking aëration. The process of denitrification has been discussed in some detail in this Journal since Warington originally showed that a pot full of a water-logged soil containing nitrate of soda lost within a week as much as 80 per cent. of the nitrate applied, the nitrogen being evolved in the form of gas. Though no such destruction occurs under field conditions, even when nitrate is used in conjunction with an excess of farmyard manure, some losses of the soil do undoubtedly occur, as may be seen from the fact that in most experiments the whole of the nitrogen applied as nitrate is not recovered in the crop even though there has been no washing out of nitrates by drainage. The bearing of denitrification upon our problem comes from the fact that when the nitrogen of the nitrate of soda is thus lost the soda base is left behind as carbonate of soda, hence from some of the nitrate of soda that is not taken up by the crop there will be carbonate of soda produced by the organisms of denitrification. Moreover there are other bacteria in the soil which will take the nitrogen from nitrate of soda; they do not waste it by setting it free as gas, but they convert it into proteins and similar substances out of which their own bodies are constructed; in these cases also the soda part of the salt is left behind as carbonate. This process is strictly comparable with the production of acid by the action of micro-fungi upon sulphate of ammonia; in each case the living organism effects a splitting of the salt in order to obtain nitrogen, and it rejects and leaves behind in the soil in the one case the acid part of the salt, in the other the base.

We are now in a position to sum up the features of this secondary action of nitrate of soda applied to the soil, an action which causes so great an injury to its texture when the land is at all heavy. The bad texture is due to the deflocculation of the clay particles which is brought about by the presence in the soil of a small quantity of dissolved carbonate of soda. The carbonate of soda is formed by the action of the crop plants and of certain soil bacteria upon the nitrate of soda, they take up the nitrogen-containing part of the salt, because nitrogen is an element indispensable to their development, and leave behind the soda base combined with the carbon dioxide which they excrete.

The next point of importance is to find both a remedy for the injured tilth of the heavy soil where nitrate of soda has been too freely applied, and a means of preventing such action in the future. Lime is of no benefit to a soil which has been deflocculated by an alkali like carbonate of soda because lime is an alkali itself and would rather tend to make matters worse. The flocculating action of lime on ordinary clay soils only takes place when the lime gets washed into the soil as soluble bicarbonate; lime itself when protected from carbon dioxide has curiously enough no flocculating action (see Hall and Morison, Jour. Agric. Sci. 1907. *2*, 244). In this particular case the flocculating action of lime would be largely masked by the carbonate of soda which would still remain in the soil. Gypsum has been used in America as a means of getting rid of carbonate of soda in those unfertile and unworkable soils known as "black alkali"; the two substances interact to form sulphate of soda and carbonate of lime. It takes, however, a large and unprofitable amount of gypsum to effect this change, and a more practical plan is always to use superphosphate as the phosphatic manure on such land. The acid of the superphosphate will go to neutralise the alkaline carbonate of soda, and the gypsum which is also present will aid in the desired flocculation of the clay particles. However, the best remedial measure is probably a liberal dressing of soot; the particles of carbon have a beneficial mechanical effect in lightening the texture of the soil, and at the same time the ammonia salts that are present in the soot are helpful in flocculating the clay. As a preventive undoubtedly the simplest and wisest plan to follow is to use instead of nitrade of soda alone a mixture in equal proportions of nitrate of soda and sulphate of ammonia on all strong soils, especially where considerable quantities of concentrated nitrogenous manure are required for market gardening purposes. Since one of these compounds tends to produce an acid and the other an alkali in the soil, they neutralise the effects of each other, and as far as the conditions depend upon the manuring, such a mixture will not disturb the reaction of the soil in one direction or the other. Moreover there is a good deal to be said for the use of such a mixture from the point of view of the nutrition of the plant; of course the great value of nitrate of soda lies in its immediate availability, but when too much is put on it may easily form a solution that is injuriously strong in certain parts of the soil. Müntz has recently shown in an interesting paper how limited is the diffusion of even so soluble a salt as nitrate of soda in the soil; it washes down with the rain, but it spreads very little laterally, and Müntz' conclusions can be verified by

the consideration of some of the Rothamsted plots. Now the ammonium sulphate mixed with the nitrate of soda would be to some extent temporarily withdrawn from solution by the soil, so that an application of a mixture of it with nitrate of soda would result in a less concentrated soil solution than would be set up by an equivalent amount of nitrate of soda alone. Yet the sulphate of ammonia would begin to nitrify very rapidly, and would thus provide food for the plant as the nitrate of soda was beginning to get exhausted. There is also some evidence, though so far it depends on conclusions drawn from experiments on a pot scale only, that plants are physiologically better served by a mixture of nitrate and ammonium salts than by either alone. However that may be, the practical points are that no inconveniences arise from making such a mixture, that it is just as effective and active as the nitrate alone, and that it sets up no injurious action, either in the direction of acidity or alkalinity in the soil, so that large amounts can be used without detriment either to the tilth or the health of the soil. There can be little doubt but that the discredit which the practical farmer sometimes attaches to nitrate of soda as a stimulant exhausting the soil, even as a "scourge" as it has been called, is due to its effect upon the tilth. Although nitrate of soda, when used alone, is a one-sided manure that will greatly aid the plant to remove the available phosphoric acid and potash from the soil, it still supplies the most important element of fertility, and cannot exhaust the soil in any real sense. At Rothamsted, where nitrate of soda among other single manures has been used on the same plots for over fifty years, the astonishing thing is the way some sort of a yield is maintained. For example, the average yield of mangolds from the plot receiving nitrate of soda alone for twenty-seven years has been 10¼ tons of roots per acre against 10 with rape cake alone; again, with nitrate of soda alone the average yield of barley for fifty-one years has been as much as 30·4 bushels per acre. The practical man, however, uses the word exhausted not in its strict sense, but as signifying any condition of the soil which lowers its crop-producing capacity; for example, wheat is spoken of as an exhausting crop, although it takes out of the land only about a third of the plant food that is removed by a crop of roots. But because wheat occupies the land for the greater part of the year, during which time no intertillage can be carried on, the soil loses its texture and falls off in its mechanical condition. The lack of cultivation may also interfere with the availability of the stores of plant food both from biological and physical causes, at any rate the land after a wheat crop is less productive because of its lack of condition and not

from any absolute poverty. For the same kind of reason then, nitrate of soda gets described as an exhausting manure, not because it robs the land in any special way, but simply because it sets up a bad texture of the soil which so easily leads to an inferior yield in the following crop.

The list indeed of these secondary interactions between fertiliser and soil which may have a potent influence on the value of the fertiliser in practice is not ended with the changes set up by nitrate of soda and sulphate of ammonia; there is plenty of practical evidence that the effect of applying potash salts such as kainit, muriate or sulphate of potash, is not wholly comprised in the provision of a certain amount of potash for the nutriment of the crop. In the first place it has often been remarked by those concerned with field experiments that cases occur when the addition of potash salts to a mixture so far from increasing the return actually reduces it. As a rule these results have been set down to the large experimental error which is inevitable in all field trials, but so convinced have been some experimenters of the reality of the effect that they have begun to speak of the "depressing effect of potash" upon the crop. Now from the point of view of nutrition alone such a depressing effect is impossible, in some way the effect must be special to the soil and due to an unsuspected interaction between soil and potash fertiliser. A clue to the sort of action to be looked for may be found in the observations which have been recorded in some of the cases where the use of potash had resulted in a lowered yield, that the ground remains a little wetter after the application of kainit or other potash salts. As in the case of nitrate of soda this apparent wetness has been set down to the water-absorbing properties of potash salts, which are chiefly due to the magnesium chloride which is always present in them, but as we have already indicated the small amount of water which is absorbable by an ordinary dressing of potash salts would be inappreciable when diffused through the soil. The wetness suggests deflocculation, and the appearance of many of the plots receiving potash at Rothamsted would bear out this view. On the mangold field in particular the characteristic deflocculation features shown by the plots receiving nitrate of soda, especially their way of drying with a tough glazed crust on top, are reproduced on the plots receiving sulphate of potash, and the worst plot of all is that which receives both of these fertilisers. Tested by the suspension of a small quantity of soil in a large bulk of pure water the opinion is confirmed that the soil of these potash plots is completely deflocculated. Another practical case has fallen under the observation of the writer where the application of 8 cwt. per acre of kainit to a piece of

heavy land which had not long before been limed, so destroyed the texture of the soil that the ploughman knew at once when he entered upon the plot in question because of the heavier draught of the plough. Accepting then deflocculation as an explanation of the injurious effects of potash salts upon clay soils the question that remains is the origin of the alkali, for alkali it must be that has brought about the deflocculation. The first investigation of the action of potash salts upon soil was carried out by the late Dr. A. Voelcker and the results were published in this Journal in 1864; he showed that an interchange of bases takes place similar to that which takes place between ammonium salts and the zeolites of the clay, potash goes into the zeolite and becomes insoluble, and an equivalent amount of lime, magnesia, and soda leaves the zeolite to combine with the acid of the potash salt. These exchanges would count for nothing in the problem, because no substance is formed which would interfere with the character of the soil.

The carbonate of lime in the soil next suggested itself as a possible reacting substance, and a series of experiments have showed that when weak solutions of potash salts remain in contact with carbonate of lime a small quantity of free carbonate of potash is produced. The figures showing the extent of the reaction have not as yet been published but the action is one of those cases where the amount of chemical change that is set up depends upon the relative quantities of the reacting bodies, so that in the soil, where the carbonate of lime would generally be in great excess, the proportion of the potash salts that could be converted into carbonate would be comparatively large. The investigation has not yet been completed, because it involves some further considerations of the part played by carbon dioxide which is also present in the soil and also of the results of partial washing of the soil as by rain, but the central fact has been established that soluble potash salts and carbonate of lime will react so as to produce carbonate of potash, which like other alkalis will bring about deflocculation of the clay. Moreover common salt has exactly a similar action, and this at once provides us with an explanation of the many unintelligible and often contradictory reports of the action of salt as a fertiliser. It has variously been reported as enabling the soil to retain more moisture, as injuring the soil, especially when the land has been flooded with sea water, as sometimes increasing but occasionally as diminishing the crop. These reports coincide with those concerning the action of potash, and the effect in both cases may be set down to the deflocculation brought about by the small trace of carbonate of soda or potash that is formed by the action of the carbonate of lime in the soil upon the soluble potash or soda salt.

Deflocculation brought about by potash salts or by common salt is rarely a matter of much practical importance, but it may be obviated by using superphosphate as the phosphatic manure going with the potash salts, and again by applying the latter fertiliser in the winter. This will give time for the reactions between fertiliser and soil to be completed and for some of the useless bye-products like the carbonate of soda to be washed out. If on arable land there will also be time for the spring frosts to restore the texture of the land before the preparation of the seed bed is taken in hand. No fear need be entertained that the valuable potash salts will be washed out of the soil. Way's and Voelcker's papers show that they are retained, and Dr. B. Dyer, in his examination of the Rothamsted soils, found that of the potash annually applied and not utilised by the crop very little had been washed away, even after fifty years of the treatment.

It will be noticed that all the effects of fertilisers upon soil which have been discussed are due to chemical changes of a comparatively minor order which were overlooked or not suspected when fertiliser actions first began to be studied, because in most cases the agent in the process is that part of the substance which possesses no value as a fertiliser. For example, sulphate of ammonia was considered as a source of nitrogen only, the sulphuric acid it contained was entirely ignored and regarded as of no account. Similarly with nitrate of soda the nitrogen is the important part upon which its value as a fertiliser depends; the mistake came in supposing that the soda was entirely without effect. The same state of affairs has occurred over and over again in the history of science; the broad conclusions reached by early generations of investigators, which become the staple of the text books and the dogma of the lecture rooms, and in the process always grow cruder and more hard and fast in statement than is justified by the original researches, prove eventually to be no more than first approximations to the truth. To complete the story, a second, sometimes even a third, term requires to be introduced, the course of events in nature being always much more complex than the nice watertight statements which our minds like to evolve under the guise of laws. These second approximations, which may become large enough to override the main truth, often make themselves evident to the practical man, who delights in them as proofs that theory and practice do not always square, though as theory can never be more than a method of explaining and in its turn predicting the practice, any want of agreement between the two must only mean that the practical man is dealing with an imperfect theory.

However it is the duty of the scientific man to recognise that practical affairs will always be stretching the range of actions

upon which he founded his general statements into regions where they will no longer fit the facts, and it is by picking up the hints of such discrepancies as the practical man can often supply, that the theory may be founded on a more accurate basis. And lastly, if one more general reflection may be permitted, the various investigations which have been described above afford an illustration of the necessity of continued research even about matters which may have become common knowledge; all our conclusions are approximate only, and every advance of knowledge calls for their re-examination in the new light; in this very question under discussion there remain one or two doubtful points which might have applications in practice, but which cannot as yet be investigated until the mathematicians and the physicists have settled some fundamental points on the interactions between liquids and solid particles.

SUMMARY.

1. The long-continued use of sulphate of ammonia on soils poor in lime results in the soils becoming acid.

2. The acidity is caused by certain micro-fungi in the soil which split up the sulphate of ammonia in order to obtain the ammonia, and thereby set free sulphuric acid.

3. The infertility of such soils is due to the way all the regular bacterial changes in the soil are suspended by the acidity; instead fungi permeate the soil and seize upon the manure.

4. The remedy, as may be seen upon the Woburn plots, is the use of sufficient lime to keep the soil neutral.

5. From the Rothamsted soils carbonate of lime is being washed out at the rate of 800 to 1,000 lb. per acre per annum, the losses being increased by the use of sulphate of ammonia, but lessened by dung or nitrate of soda.

6. Nitrate of soda, when applied to heavy soils in large quantities, destroys their texture.

7. Some of the nitrate of soda gets converted into carbonate of soda by the action of plants and bacteria, and carbonate of soda, by deflocculating the clay particles, destroys the tilth.

8. The best remedies are the use of soot or superphosphate; the best preventive is the use of a mixture of nitrate of soda and sulphate of ammonia instead of either separately.

9. Soluble potash manures and common salt may also injure the tilth of heavy soils through the production of a little soluble alkali by interaction with carbonate of lime in the soil. The remedy is to apply such manures in the winter or in conjunction with superphosphate.

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DAIRY CATTLE AND THE BUTTER TEST: TWENTY YEARS' EXPERIENCE,

By Ernest Mathews,

With a *Report on some Investigations of the Factors which Influence Churnability*,

BY

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I PROPOSE in the following pages to review shortly the butter-test and milk-test trials with which I have been associated, more or less, during the past twenty years, and in doing so I shall endeavour to show that they have been productive of some good, but in making this last statement I would have it clearly understood that to the late Mr. John Frederick Hall, of Sharcombe, Wells, Somerset—the originator of the butter-test trials—whose views on the subject were far in advance of his time, the credit for any good that can be traced to them entirely belongs.

Another fact possibly known only to me has impelled me to rush into print, that is, that on those trials which I alone have conducted, sums of money in prizes and attendant expenses amounting to at least 9,000*l.* have been entrusted to me to look after. I am sure, therefore, it will be readily understood that I feel constrained to give an account of my stewardship, and to try and show that these large sums of money have not failed to further the cause to which they have been given.

It is not necessary to describe the way in which butter tests or milk-yield trials are carried out, as the conditions, report, and tables are published after each competition, those for the past year at the R.A.S.E. Show at Gloucester being found on page 221. I would, however, refer specially to the figures under the heading "Butter Ratio" and to the averages of the various breeds, as from these the most valuable information is to be obtained.

The butter ratio figures are got at by dividing the weight of milk by the weight of butter obtained, the quotient giving the number of pounds of milk used to make one pound of butter. If the quotient be divided by 10·3 the weight of milk will be shown in gallons.

The first butter-test trials were held at the London Dairy Show in 1886, but until 1889 centrifugal cream separators were not used, the cream being scalded on the Devonshire system, and the butters made by hand.

I first assisted at one of these competitions at the Show held by the English Jersey Cattle Society, for Jerseys, at Kempton Park, in the spring of 1890. I did little beyond seeing that the cattle were milked out, and the milks taken to the dairy tent, but I have a lively recollection of the noise made by the separator, and of the time taken in passing the milk through that machine. Recalling the scene on that day and comparing it with similar work now, when with steam

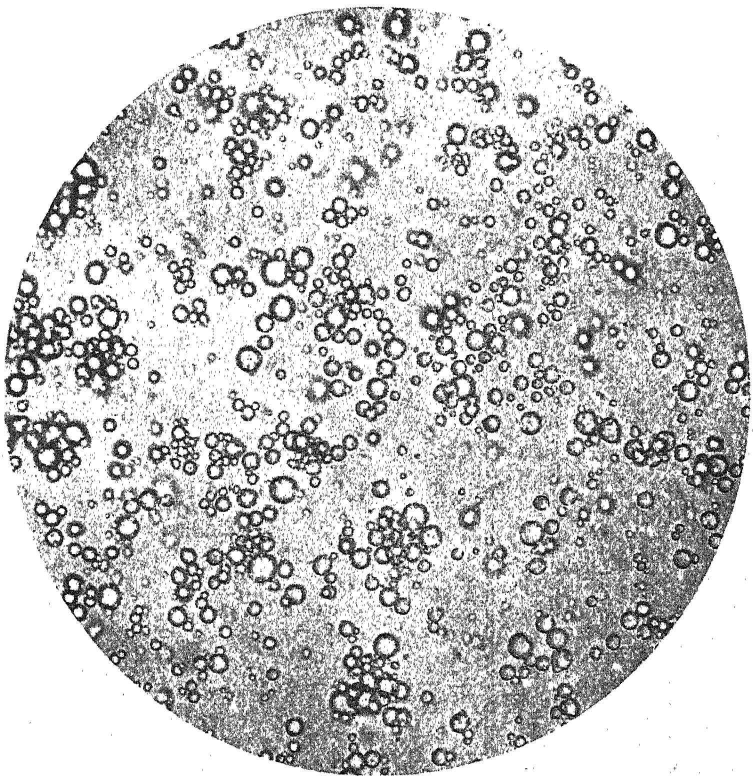

FIG. 1.—Shorthorn. Milk × 500 diam.

turbine separators, dealing with nearly double the quantities of milk per minute, there is scarcely any sound, one cannot wish for a better illustration of the advance that has taken place generally in all matters connected with dairying.

At Kempton Park, Mr. Hall added a gill of butter-milk to each lot of cream to act as a "starter," but this practice has not been continued, as objections have been taken, and perhaps

rightly, to the addition of anything to the creams in trials of this kind.

The first test that I conducted alone was at the Royal Counties Show at Winchester, in July, 1890. The weather was exceedingly cold, and as the churnings commenced at 7.15 a.m., the full quantities of butter were apparently obtained. The difficulties attendant on the churning of sweet cream were not then realised, and the accident of the weather appears to me to have been solely responsible for the good results.

To Dr. Herbert Watney the discovery of the correct temperature at which the comparatively sweet Jersey creams in a butter test should be churned is due. Being dissatisfied with the result of one test, he carried out the following experiment in his own dairy. Dividing one lot of cream into three equal parts and churning at 54°, 58°, and 62° Fahr., he found that at the higher temperatures a certain amount of butter fat passed off into the butter-milks. Re-churning the butter-milks of those churned at 58° and 62° he regained the lost butter, which, added to the lots first churned, made the amounts of the three lots practically equal. As a result of this experiment the temperature at which creams in a butter test should be churned was settled, and with the late Mr. Weetman I carried out the first test under these new conditions at the Royal Counties Show at Redhill in 1892, the creams being churned at 54° Fahr.

In all the trials which I have carried out since, I have taken 52° Fahr. as my standard, and have published a churning table with the awards (*vide* pages 226 and 227).

In 1893 butter-test competitions were held for the first time in Jersey, at the Royal Agricultural Society's Show at Chester, with the Hon. A. E. Parker as Judge, and at the Tring Agricultural Association's Show, since which they have increased in number, being now included in the programme at the three shows named above, as also at the Bath and West of England, the British Dairy Farmers', and the Tunbridge Wells Shows, in all cases, except Jersey, being open to cattle of any breed or cross.

Mr. Hall's original idea in starting these trials was (*a*) to show that the Jersey was a profitable animal and not merely a fancier's cow, and (*b*) to try and resuscitate the butter-making industry and remove the "stigma of unprofitableness which rested upon butter-making in England."[1]

That the Jersey is a profitable animal is now generally recognised, but that the manufacture of butter in England on a large scale (unless the milk of Channel Island cattle only is used) will ever be as remunerative as milk-selling,

[1] "The Jersey as a Butter Cow." B. and W. E. Journal, Vol. II., Ser. 4.

is doubtful; although a great deal more butter is now made than was the case in 1886, and with the greater knowledge acquired since that date, of far better quality, and consequently saleable at better prices.

But although Mr. Hall's expectations with regard to the revival of the butter industry may not have been altogether realised, the amount of information brought to light through these and the milk-yield trials has been considerable.

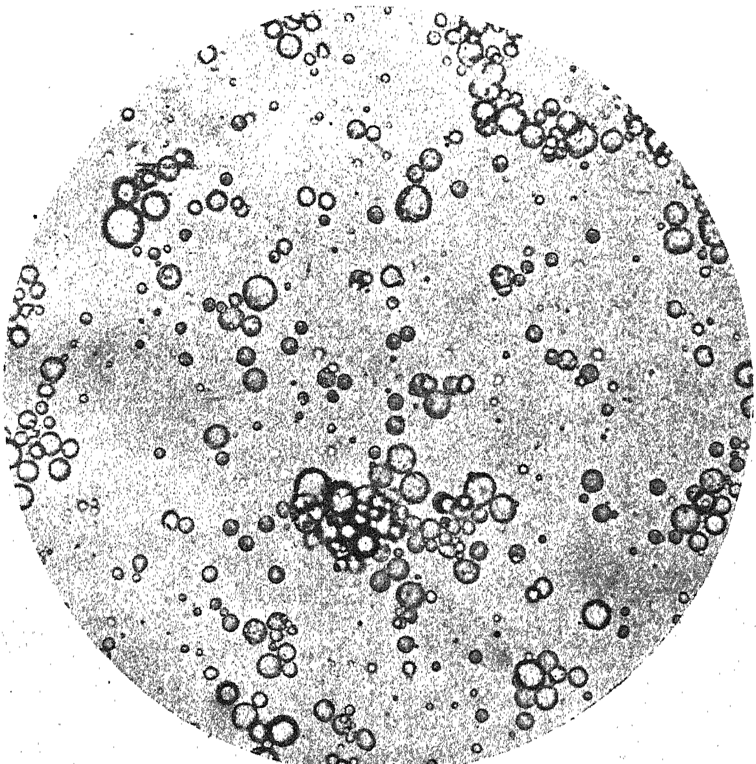

FIG. 2.—Lincolnshire Red Shorthorn. Milk × 500 diam.

Dairy Cattle.—First commencing with the cattle exhibited, I am satisfied, after having examined over 3,500 individual cows in these competitions, and noted the respective yields of milk, that the "dual-purpose cow," by which is meant the cow that will yield the maximum quantity of milk up to standard, and at the same time be a good butcher's beast, is seldom seen. In America this is acknowledged, but in England the "dual-purpose cow" has still many followers.

To go into the peculiar attributes of the milking and butter-yielding cow as disclosed by these trials would occupy too much space, and there is the less need for it as I have already done so,[1] but I may again state here that I have seen nothing in the later trials to make me modify in any way the opinions expressed above.

I would, however, specially call attention to the great improvement noticeable in the yields of some of the well-

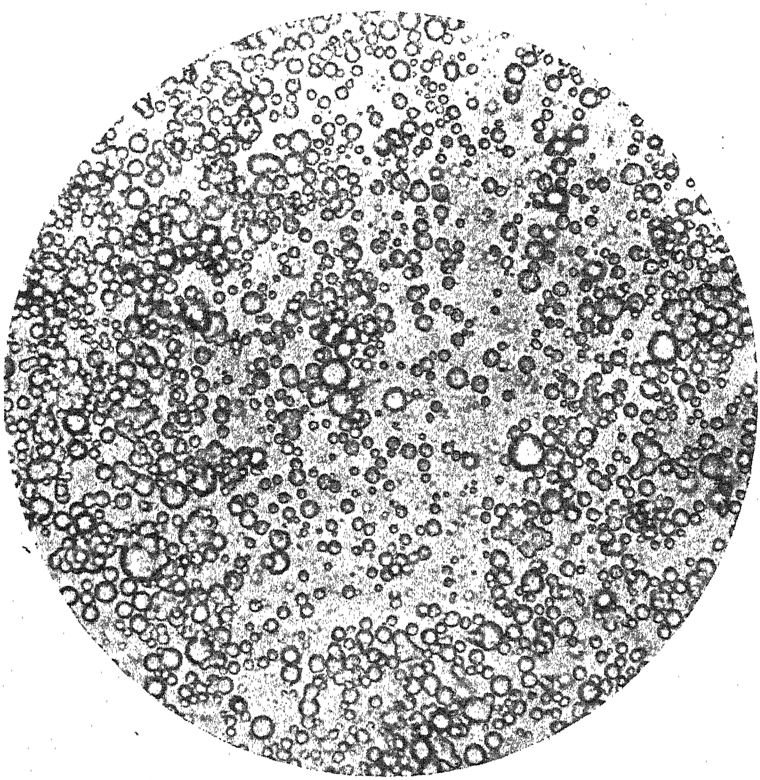

FIG. 3.—Devon. Milk × 500 diam.

known milking breeds. As an instance I would refer to the pedigree Shorthorn cows. Nine years ago the average points gained by, and so the position of, these cattle in the milking trials at the London Dairy Show were the lowest of the heavy breeds, whereas now, in a great measure due to the establishment of the Dairy Shorthorn (Coates' Herd Book) Association, they stand in the front rank.

[1] Economics in Dairy Farming, "Country Life Library."

A little more attention paid to the improvement of the quality of the milk of all the heavier breeds in the milk-yield classes should result in fewer disqualifications on the score of "deficiency in fat," as the butter-test trials have shown pretty conclusively that "richness of milk is transmissible."

This is exemplified in the history of the Jersey cow. The old Island breeders paid special attention to the use of butter bulls, that is, animals descended from cows well known for the

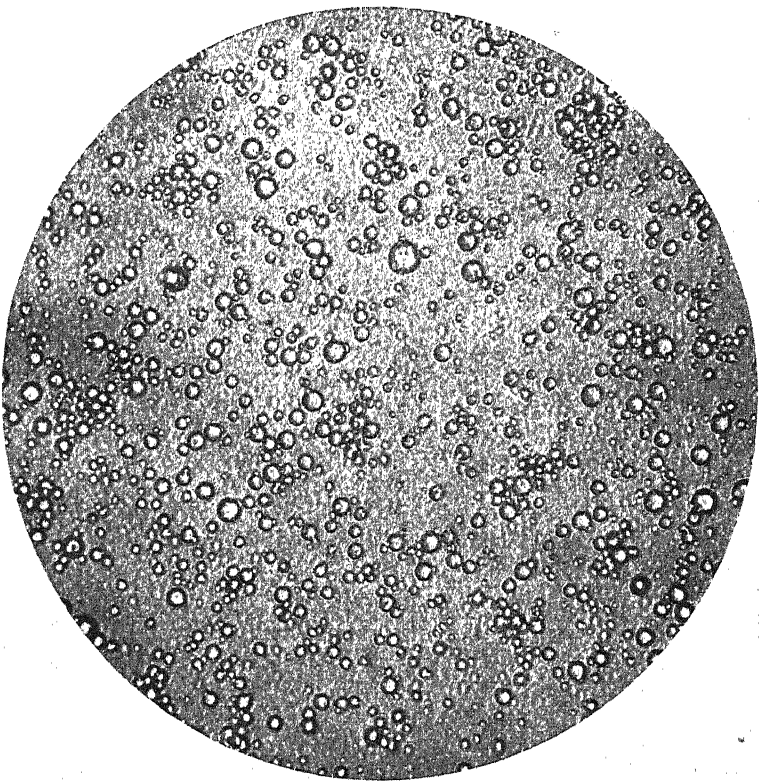

FIG. 4.—South Devon. Milk × 500 diam.

richness of their milk and cream. At the same time, the shape and capacity of the udder was made a *sine quâ non*, and consequently these characteristics became "fixed." As an illustration I would refer to the celebrated Island bulls, *Golden Lad*, his son, *Boyle*, and grandson, *Golden Fern's Lad* by *Boyle.* Those of my readers who have seen and remember these animals can bear testimony to the remarkable

way in which the produce of these three sires on the female side inherited all the characteristics mentioned above.

One illustration on the female side to show that richness of milk is transmissible will suffice. *Fancy*, a Jersey cow, won three gold medals at the May Butter Test in Jersey in the years 1893, 1894, and 1896, with the following yields of butter:—2 lb. $8\frac{1}{2}$ oz., 2 lb. $11\frac{1}{2}$ oz., and 3 lb. $3\frac{1}{2}$ oz. Her daughter, *Fancy's Pride*, only competed in 1897, when she won the gold medal with 3 lb. $2\frac{3}{4}$ oz. of butter, having been 97 days in milk. Her daughter, *Fancy's Rose*, won the first prize at the October Test in the Island with 2 lb. $6\frac{1}{2}$ oz. of butter, having been 240 days in milk.

Quality of Milks.

Although it is now easy to get at the average quality of the milks yielded by the different breeds of cattle, from the reports of the butter-test trials, yet, previous to 1886, no information that can be considered as authoritative is to be found in any of the books on cattle or dairy-farming then extant, the reason apparently being that up to that time no experiments open to the public (and so to criticism) had been carried out. It was generally admitted that the milks from the Channel Island cattle were richer than from other breeds, because the fat globules in those milks were said to be larger than in others.

With the advent of the butter-test trials and the publication of the butter ratio averages, as also of the milk analyses, the quality of the various milks was soon ascertained, and the following figures represent as nearly as possible the amount of milk required to make one pound of butter in the case of each breed mentioned:—

Milk required to make 1 lb. of Butter.

Breed	Ratio	Gallons
Red Poll Welsh	30·00	3
Shorthorn Lincoln Red Shorthorn Ayrshire	27·50	$2\frac{3}{4}$
South Devon Kerry Dexter	26·00	$2\frac{3}{5}$
Longhorn	22·50	$2\frac{1}{4}$
Guernsey	21·00	$2\frac{1}{10}$
Jersey	19·00	$1\frac{9}{10}$

These figures vary somewhat in different trials because there may be very few cattle in a particular test, and those

abnormally good or bad, but taking the trials as a whole the figures given above will, I believe, be found as nearly accurate as possible. The practical good derived from a knowledge of the butter ratio figures is that, given the price of milk, the cost of making butter from that milk can be readily arrived at. An example will make this clear. If the price of milk is estimated at *8d.* per gallon, the butter made from the milks of

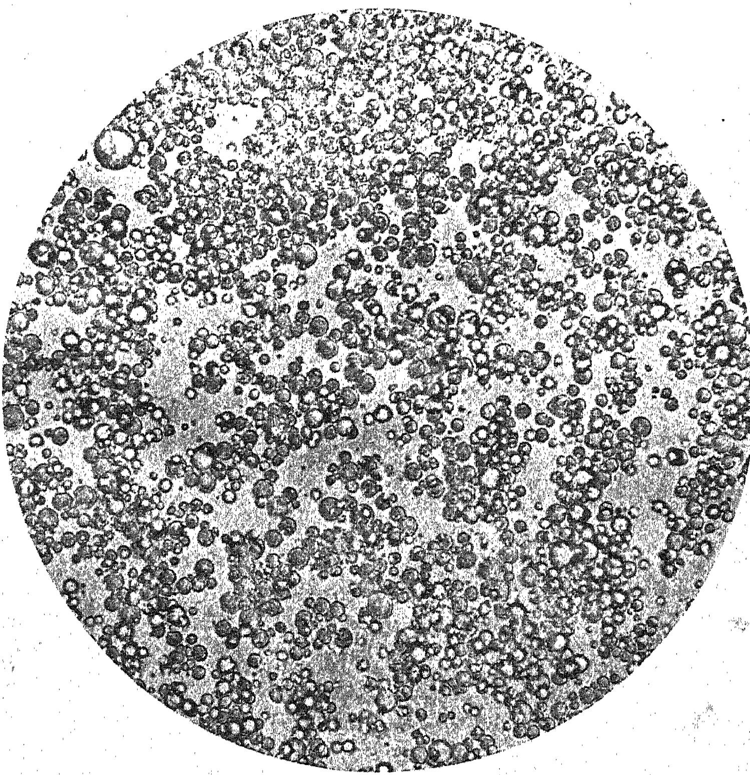

FIG. 5.—Longhorn. Milk × 500 diam.

the various breeds, eliminating the value of the separated milk, will work out as follows :—

	Per lb. *s.*	*d.*
Red Poll and Welsh	2	0
Shorthorn, Lincoln Red Shorthorn, and Ayrshire	1	10
South Devon, Kerry, and Dexter	1	8¾
Longhorn	1	6
Guernsey	1	4¾
Jersey	1	3¼

In the early days of butter-testing, these figures exercised me much, as I could not understand how butters of the highest quality, and supposed to be genuine, could be sold at the very low prices then in force, more particularly as I knew from Mr. Hall's writings,[1] as also from independent authorities, that the butter ratios of the cattle in those European countries from which the greater part of the imported butters came, varied from 26·00 lb. to 30·00 lb., and that the cost of milk in those countries was never quite as low as 2½*d.* to 3¼*d.* per gallon.

Acting on this knowledge, I called attention in 1895 to the very low prices at that time quoted for French, Danish, and Dutch butters, which ranged from 80*s.* to 90*s.* per cwt., and I urged as strongly as I could that all imported butters should be examined at the port of entry.[2]

Under the Margarine Act of 1899, this condition became law, mainly through the exertions of the English Jersey Cattle Society, and the correctness of one's suspicions was at once demonstrated by the rise in prices of the butters exported to this country after the Act came into force. These remarks do not apply to the Irish and Colonial butters, the prices of which were kept down by the foreign butters, because it was well known at that time that the price of milk in Ireland was almost 50 per cent. under the English price, while our colonists were glad to get 2½*d.* from the factories for milk which was otherwise unsaleable.

Period of Lactation.

In the early days of butter tests no points were allowed for the length of time a cow had been in milk, although in the milking trials at the Dairy Show the period of lactation had always been taken into consideration. The result was that heavy-milking, fresh-calved, cross-bred cows were always very high up in the prize list, although they were not often heard of subsequently. The allowance of points for lactation quickly put matters right, and did more than that, for they showed that the more profitable cows are those which keep up their flow of milk. From a perusal of the lactation figures under the heading "days in milk," which will be found in the Reports of various Butter Tests, it will be seen that the Channel Island cattle apparently milk longer than other breeds.

Colour and Quality of Milk and Butter.

In 1890, a column was added to the butter-test tables, for colour and quality of butter, although no points were awarded

[1] "The Jersey as a Butter Cow." B. and W. E. Journal, Vol. II., Ser. 4.

[2] "Thoughts suggested by the Tring Dairy Trials." Live Stock Journal Almanack, 1896.

for either. It was, I believe, thought that these attributes would afford some clue to the feeding of the various animals, but this is a mere surmise, as I can find nothing in Mr. Hall's writings bearing on the subject, except that at Kempton Park he reported in one case "the excessive use of mangolds had destroyed every trace of colour" in the butter.

Whatever the reason may have been, the Judge is in duty bound to look at all the butters made in a butter test and record, shortly, his impressions.

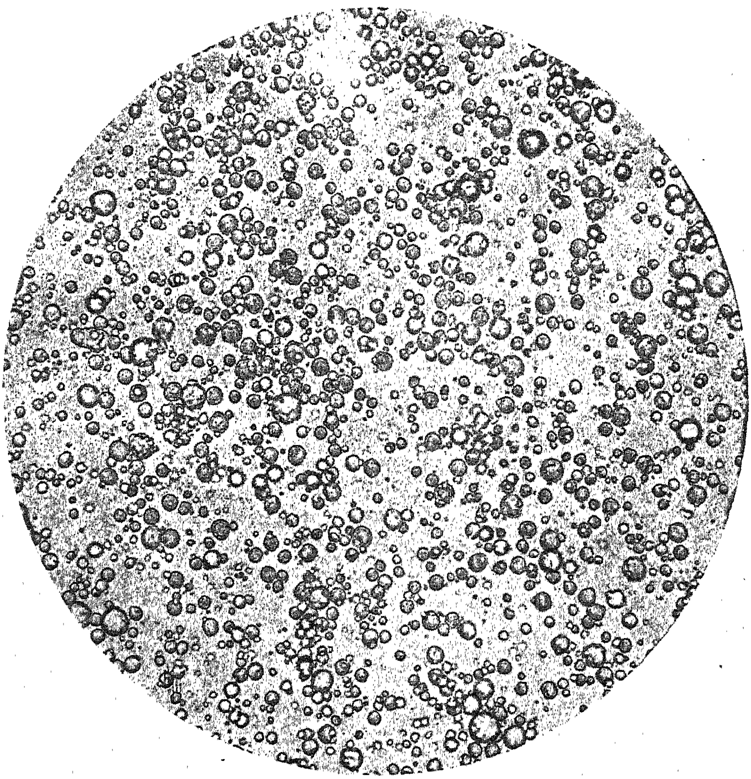

FIG. 6.—Red Poll. Milk × 500 diam.

It will, I think, be obvious to the reader that where some sixty or seventy samples of butter have been made at a butter test—the milks, creams, and butters having all been treated alike—the differences in colour and quality must be put down entirely to the differences in the quality of the milks. Having inspected at the various trials I have conducted, over 3,100

lots of butter, all made under similar conditions, which are as correct as it is possible to get them, I am satisfied that—

(*a*) The colour of both milk and butter is a true indication of its quality.

(*b*) The deeper the colour, the better the quality of both.

(*c*) The colour, and so the quality of both, can be impaired by improper feeding.

Whether these views on colour are right or wrong, it will be readily understood that, believing them to be correct, I have on every available opportunity denounced the colouring of these two articles of food as tending to deceive the public, and in order to satisfy myself that these opinions are not incorrect, I have carried out certain colouring experiments in the dairy at the Shows of the Society during the past three years, the reports of which will be found under the heading "Experiments in the Dairy."

Churnability of Creams.

Although, as mentioned above, the creams in a butter test are always churned at the low temperature of 52° Fahr. in order to get the maximum weight of butter, yet from time to time cases have occurred where the butter-milks, showing traces of cream, have had to be re-churned.

As these cases were particularly noticeable in the creams of certain breeds, I carried out, through the indulgence of the Council of the Bath and West of England Society, certain experiments in the dairy at their shows held at Croydon, Plymouth, and Exeter, full reports of which appeared in the Journals of that Society.[1] At these trials, where I had the valuable assistance of Dr. J. A. Voelcker, M.A., F.I.C., Messrs. F. J. Lloyd, F.C.S., F.I.C., Droop Richmond, F.I.C., and F. V. Dutton, the Agricultural Instructor to the Devon County Council—the last named examining all the creams under the microscope and subsequently photographing them—the following conclusions were arrived at:—

(1) "That milks containing small and irregular-sized fat" "globules do not churn as well as those having large and" "regular-sized ones, the small fat globules being lost both in" "separation and churning."

(2) "That churning perfectly sweet cream results in con-" "siderable loss."

(3) "That the loss of the small fat globules in separation" "and in the first churning, accounts for the difference be-" "tween the analytical and practical tests."

[1] Journal of the B. and W. of E. Soc., Vols. XII., XIII. and XIV., Ser. 4.

Previous to these experiments, the only writers who had gone thoroughly into the subject appear to have been Dr. E. Lewis Sturtevant and Professor Frederick D'Hont.

An abridged report by Dr. Sturtevant on the "Dearfoot Farm Centrifugal Dairy" will be found in the Journal of the Royal Agricultural Society of England,[1] while a translation by Mr. F. J. Lloyd, of D'Hont's paper on "The Fat

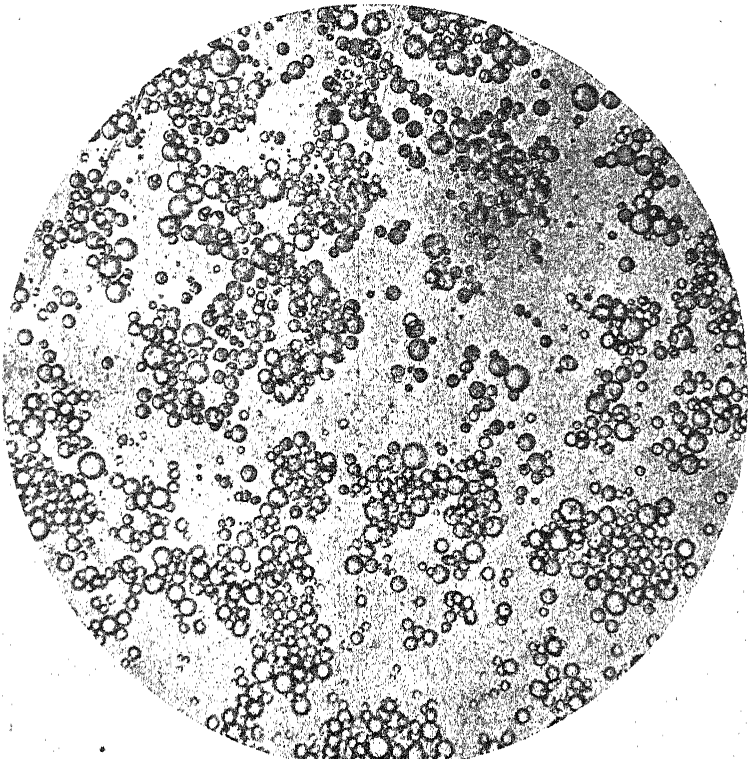

FIG. 7.—Ayrshire. Milk × 500 diam.

Globules of Milk" appears in the Bath and West of England Society's Journal.[2]

Although some of the conclusions arrived at in these articles would not now be accepted as correct, yet on the question of churnability of cream, they both agree in one particular—that the "larger the globules, other things being equal, the quicker the churning," to which it is suggested

[1] Journal R.A.S.E., Vol. XXXVII., Pt. 2, 1882.

[2] B. and W. of E. Society's Journal, Vol. I., Ser. 4, 1890-1891.

may now be added, the more uniform the globules, the better will be the results as regards weights of butter obtained.

The creams in a butter test are not absolutely sweet, being the produce of two milkings—the first, twenty-four hours, and the second, twelve hours before the creams are churned. These creams are mixed twelve hours before they are churned, so that they cannot be classified either as ripened or sweet. For this, the exigencies of the Show are responsible.

By churning the creams at the low temperature of 52° Fahr., the operation of churning is retarded, with the result that frequently the butter gets into what is known as the "sleepy" stage or comes in such small grain that it would probably run through the bag of the "Delaiteuse." In these cases the practice has been as follows:—Churning is stopped and the lid and sides of the churn are washed down with water at 75° to 80° Fahr., thus slightly raising the temperature of the cream, when, as a rule, the butter comes at once, while the butter-milks on subsequent examination usually show no trace of cream.

In my opinion churning at the low temperature keeps the larger globules from collecting quickly into butter, while the length of time and the subsequent raising of the temperature not only acts beneficially on the large, but on the small globules as well.

Whether this explanation is correct or not, I feel bound to mention that this practice is supposed to be contrary to the rules of good butter-making, although I have never found the quality of the butters affected thereby.

It is a well-known fact that even with the most careful "separation" and churning some small percentage of butter fat will generally be found in the separated and butter-milks, the amount, however, being usually so small that it is not visible and no butter can be obtained from it.

In the belief that a little more light might be thrown generally on this question of non-churnability of cream, through the kindness of several breeders of pedigree cattle, I examined a good many samples of various milks which were sent to me for the purpose, using a Gerber tester and a microscope fitted with a $\frac{1}{6}$ inch objective and a No. 4 micrometer eyepiece. The results of my cursory examinations were contrary to what I anticipated, for, while in some of the milks the fat globules were fairly constant in size, in others, particularly in some of the Red Poll and Shorthorn milks, the globules ranged over a much wider field.

Examining separated and butter-milks, I found that while the bulk of what few fat globules were present were 2μ and

1μ in diameter, yet there were also one or two larger globules.

Under these circumstances I asked permission from the Society to be allowed to carry out some special experiments in the Dairy at Gloucester, and this was readily granted.

Mentioning the matter incidentally to Sir Richard Cooper, he was good enough to obtain permission from his son, Mr. W. F. Cooper, at that time in Africa, for me to visit the latter's

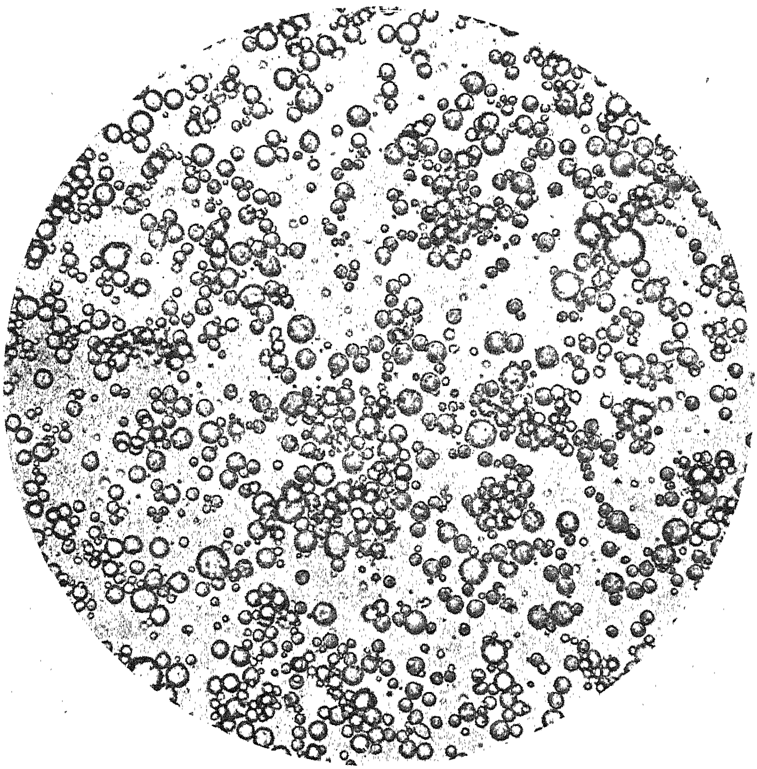

FIG. 8.—Jersey. Milk × 500 diam.

private laboratory at Watford, and to consult Messrs. Robinson and Nuttall on the subject. This I accordingly did and discussed the whole matter with them, and as a result of our deliberations the following experiment was arranged and subsequently carried out.

A sample lot of 31 lb. of milk was taken from the bulk of each of the milks of the various breeds of dairy cattle in the

Show-ground at Gloucester. As these milks were brought into the dairy in the morning the larger sample was collected and from each lot of 31 lb. two samples of 8 oz. each were taken by a special sampling tube (see page 232), one sample being sent to Watford and the other retained by me.

With the exception of the Red Poll milk (this was required for the Wensleydale cheese experiment, page 236), and the Welsh (the quantity in that case being less than half a gallon), each lot of milk was made into butter, precisely as in a butter test, samples of the separated and butter-milks being also taken for the determination of fat by the Gerber tester.

Unfortunately the butter-milk from the Shorthorns was lost, so that the experiment as regards the churning of the Shorthorn milk is worthless.

The following Table gives the weights of butter churned, the weights of butter calculated from the fat found by analysis in the new milk, the separated milks, and the butter-milks, these two latter being calculated as butter and their weights added to that of the butter actually churned, so as to compare the difference between the actual and the calculated weight of butter :—

Breed	Milk	Fat	Weight of Butter calculated from Fat + 10% of Water	Weight of Butter churned	Fat in Separated Milks (Gerber)	Weight of Butter calculated from Separated Milk + 10% Water	Fat in Butter-milks (Gerber)	Weight of Butter calculated from Butter-milks + 10% Water	Weight of Butter calculated from Fat in Milk + 10% of Water	Weight of Butter churned + (calculated) weights from + Separated and Butter-milks
	Lb. oz.	%	Lb. oz.	Lb. oz.	%	oz.	%	oz	Lb. oz.	Lb. oz.
Shorthorn	30 0	3·07	1 0⅓	0 14½	0·1	½	lost	lost	—	—
Lincoln Red do.	30 0	3·32	1 1½	1 0½	0·1	½	0·15	¾	1 1½	1 1¾
Devon	30 0	3·43	1 2 1/10	1 1½	0·05	¼	0·1	½	1 2 1/10	1 2¼
South Devon	30 0	2·73	0 14⅔	0 13¼	0·05	¼	0·15	¾	0 14⅔	0 14¼
Longhorn	30 0	4·66	1 8⅔	1 7¼	0·1	½	0·2	1	1 8⅔	1 8¾
Ayrshire	30 0	3·79	1 3⅓	1 2	0·05	¼	0·3	1½	1 3⅓	1 3¾
Jersey	30 0	4·29	1 6⅔	1 5¼	0·1	½	0·05	¼	1 6⅔	1 6
Guernsey	30 0	4·47	1 7⅔	1 6¾	0·1	½	0·05	¼	1 7⅔	1 7¼
Kerry	30 0	4·13	1 5⅔	1 4¼	0·05	¼	0·05	¼	1 5⅔	1 4¾
Dexter	30 0	4·87	1 9 7/10	1 8½	0·1	½	0·2	1	1 9 7/10	1 10
Gloucester	28 4	4·92	1 8½	1 7	0·15	¾	0·05	¼	1 8½	1 8

In looking at these figures, it must be remembered—

(1) That the milks were taken from the mixed milks of several cows, while in all cases of non-churnability in a butter test, the milk is the produce of one animal.

(2) That while the percentage of fat shown in the separated milks is fairly uniform, it is not so in the case of butter-milks.

The samples of milk from the thirteen different breeds of cows sent, as mentioned above, from Gloucester on the morning of Wednesday, June 23, 1909, arrived the same afternoon at the Cooper Research Laboratory.

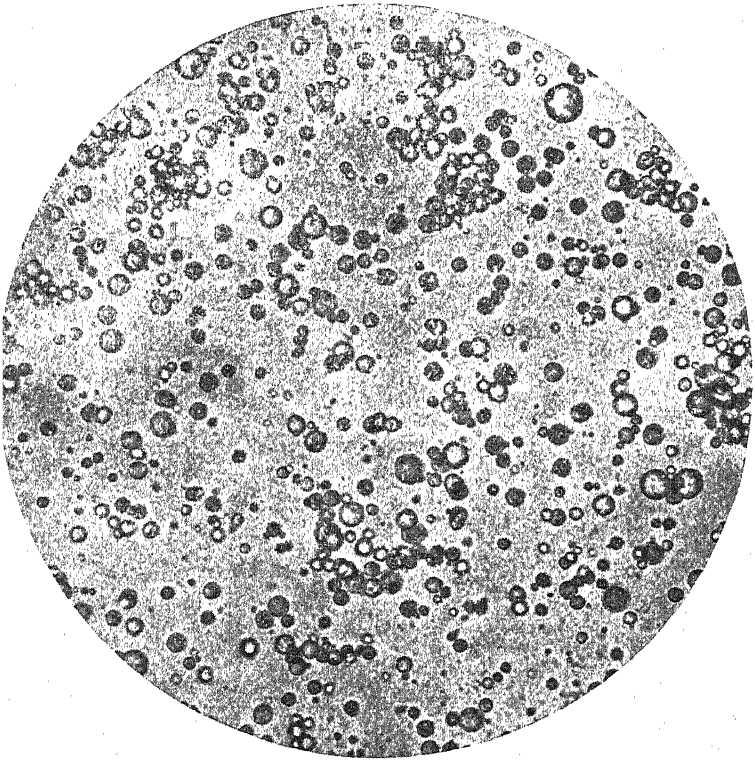

FIG. 9.—Guernsey. Milk × 500 diam.

The following is a report from Messrs. Cooper, Robinson & Nuttall :—

REPORT FROM THE COOPER LABORATORY FOR ECONOMIC RESEARCH.

The milks on arrival were analysed for the determination of fat by Adam's Extraction Method with petroleum ether as a solvent.

The percentage of fat in sample 13 is exceptionally high and inquiry elicited the fact that this sample had been obtained independently of the remainder, and did not fairly represent the bulk.

TABLE I.—*Analyses of Milk Samples.*

No.	Sample	Fat
		per cent.
1	Shorthorn	3·07
2	Lincoln Red Shorthorn	3·32
3	Devon	3·43
4	South Devon	2·72
5	Longhorn	4·66
6	Red Poll	2·99
7	Ayrshire	3·79
8	Jersey	4·29
9	Guernsey	4·47
10	Kerry	4·13
11	Dexter	4·87
12	Gloucester	4·92
13	Welsh	7·20

PHYSICAL INVESTIGATIONS.

In order to determine the numbers and relative sizes of the globules in different samples (see Figs. 1-13), photomicrographs of thin films of the undiluted milks at a magnification of 1,000 diameters were obtained. A single drop of the milk was taken from a well-shaken sample by means of a standard platinum wire loop such as is used for inoculating the tubes of nutrient broth in a Rideal-Walker germicide test. The drop was placed on a glass slip and covered with a five-eighths inch circular cover glass, the latter being carefully lowered into position with no pressure other than that of its own weight; the preparation was then ringed round with vaseline to prevent evaporation.

On account of the very considerable oscillation (Brownian movement) of the finer globules, very short exposures only were found to be admissible, and by the use of very rapid plates the exposure was reduced to one-fiftieth of a second. Prints of fields representing an area of 0·155 mm. by 0·11 mm. were thus obtained; all the globules in each field were counted and measured, and from the numbers and sizes so obtained, Table II., representing the percentage numbers of different sizes of fat-globules in the thirteen different breeds was computed.

TABLE II.—*Percentage of Different Sizes of Fat-corpuscles in Milk of Various Breeds of Cows.*

No.	Breed	12μ—10μ	9μ—7μ	6μ—4μ	3μ—1μ
		Per cent.	Per cent.	Per cent.	Per cent.
1	Shorthorn	—	1·38	22·39	76·23
2	Lincoln Red Shorthorn	1·14	5·38	39·62	53·85
3	Devon	—	0·86	24·03	75·11
4	South Devon	—	0·28	20·14	79·59
5	Longhorn	0·09	0·85	33·80	65·26
6	Red Poll	—	1·60	31·79	66·61
7	Ayrshire	—	1·24	32·75	66·01
8	Jersey	—	2·51	32·30	65·19
9	Guernsey	—	2·94	31·18	65·88
10	Kerry	—	1·73	33·66	64·61
11	Dexter	—	2·98	35·58	61·43
12	Gloucester	—	1·23	22·16	76·61
13	Welsh	—	0·83	29·47	69·74

The volume of each size of fat-globule, from 1μ to 12μ[1] in diameter having been calculated, Table III. was computed, and upon the figures so obtained all conclusions should be based. Unless it is realised that the rate of increase in volume of a sphere as successive increments are added to its diameter,

TABLE III.—*Percentage of the Total Fat contained in Globules of each of the different Sizes calculated from Table II.*

No.	Breed	12μ—10μ	9μ—7μ	6μ—4μ	3μ—1μ
		Per cent.	Per cent.	Per cent.	Per cent.
1	Shorthorn	—	12·73	63·41	23·86
2	Lincoln Red Shorthorn	16·86	26·85	50·12	6·18
3	Devon	—	10·35	64·53	25·13
4	South Devon	—	2·52	66·36	31·12
5	Longhorn	1·98	6·78	71·84	19·40
6	Red Poll	—	12·89	69·54	17·57
7	Ayrshire	—	9·86	74·55	15·59
8	Jersey	—	16·63	71·80	11·56
9	Guernsey	—	21·11	63·71	15·18
10	Kerry	—	11·98	71·99	16·04
11	Dexter	—	20·17	64·71	15·14
12	Gloucester	—	12·18	61·73	26·10
13	Welsh	—	8·52	67·48	24·00

is enormously great, deductions based on numerical expressions of the quantity of fat-globules in a sample of milk are apt to be misleading. In order to emphasise this point it has been

[1] One micron (symbolised by the Greek letter μ)=one-thousandth of a millimetre, approximately 1/25,000 of an inch, and is the unit of length in the measurement of microscopic objects.

To give some idea of its size, a small pin's head six-hundredths of an inch across would be said to be 1,500 microns in diameter.

thought worth while to insert Table IV., showing the volumes in cubic microns of spheres ranging from 1 to 12 microns in diameter.

TABLE IV.—*Table of Diameters and Volumes of Spheres.*

Diameter	Volume	Diameter	Volume
12 μ	904·8 c.μ.	6 μ	113·1 c.μ.
11 μ	696·9 c.μ.	5 μ	65·4 c.μ.
10 μ	523·6 c.μ.	4 μ	33·5 c.μ.
9 μ	381·7 c.μ.	3 μ	14·1 c.μ.
8 μ	268·1 c.μ.	2 μ	4·1 c.μ.
7 μ	179·5 c.μ.	1 μ	0·5 c.μ.

Table V. is obtained from the figures in Table III. and is self-explanatory. The degrees of uniformity in the sizes of the fat-globules was estimated by plotting on squared paper the percentage of fat in volume, against the different sizes of the globules, *i.e.*, the figures in each of the horizontal rows on Table III. (but giving the percentage of sizes for each micron from 1 to 12) against the respective diameters of the fat-globules. From the curves so obtained, the degree of uniformity is readily estimated, the sharper the rise and fall of the curve, the less uniform is the distribution in size of the fat-globules of the milk. As in Table V. the different samples are placed in order, from the coarsest (Lincolnshire Red Shorthorn) to the finest (South Devon), it is not necessary to attempt a classification of the different breeds of milk into degrees—"coarse," "medium," and "fine."

TABLE V.

No.	Breed	Amount of fat contained in globules of 5 μ and upwards	Uniformity in size of globules
		Per cent.	
1	Lincoln Red Shorthorn .	81·61	Fair.
2	Jersey	71·92	Fair.
3	Dexter	65·46	Fair.
4	Guernsey	64·58	Good.
5	Ayrshire	63·09	Poor.
6	Red Poll	62·56	Bad.
7	Kerry	60·02	Very Good.
8	Shorthorn	55·02	Good.
9	Longhorn	53·75	Fair.
10	Gloucester	51·68	Very Good.
11	Welsh	45·12	Poor.
12	Devon	44·74	Poor.
13	South Devon	37·31	Poor.

CONCLUSION.

One of the first questions which arises in connection with the churnability of milk is that of its physical character. The consideration of milk as an *emulsion*, in the strict sense of the term is by no means universally accepted. The presence or absence of an *albuminous* or *mucoid* enveloping film round each fat-corpuscle is not yet satisfactorily determined. In either case the point need not be considered, inasmuch as

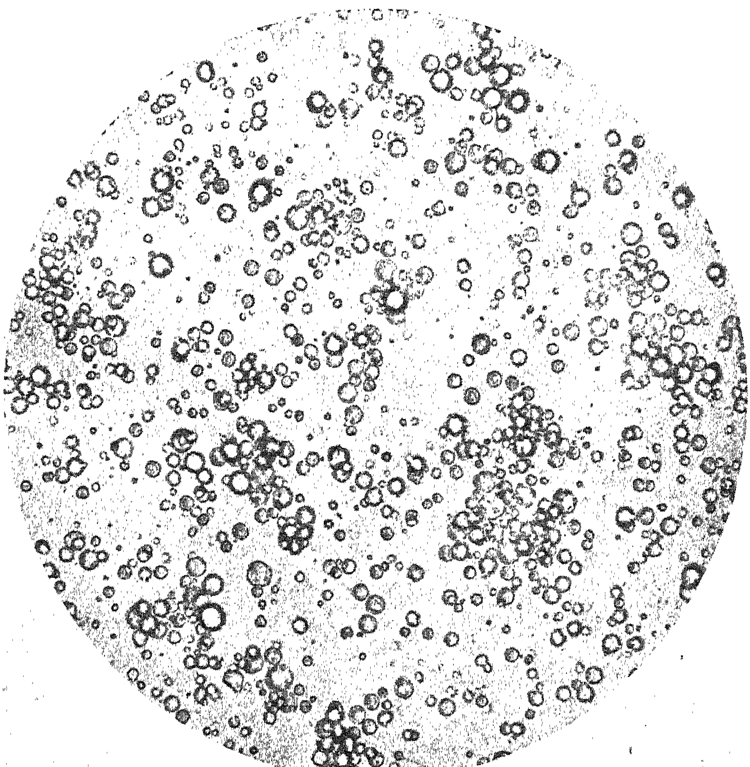

FIG. 10.—Kerry. Milk × 500 diam.

the condition, whatever it may be, is the same in all the different breeds and therefore is not responsible for the observed differences in the relative churnabilities of milks.

Another question for investigation is the influence of the variable proportions of the chemical constituents of the milk serum. The emulsifying powers of *casein*, and, in a lesser degree, *lactose*, are well established facts; and, in view of

this, it is conceivable that the churnability of the milk might be affected by the quantities of these substances present. Support is lent to this hypothesis by the fact that a sour sample of a milk will churn more readily than a fresh sample of the same milk, from which it would appear that the conversion of a portion of the *lactose* into *lactic acid* and the resultant partial precipitation, in an inert form, of the *casein*, reduces the quantities of these emulsifying agents in

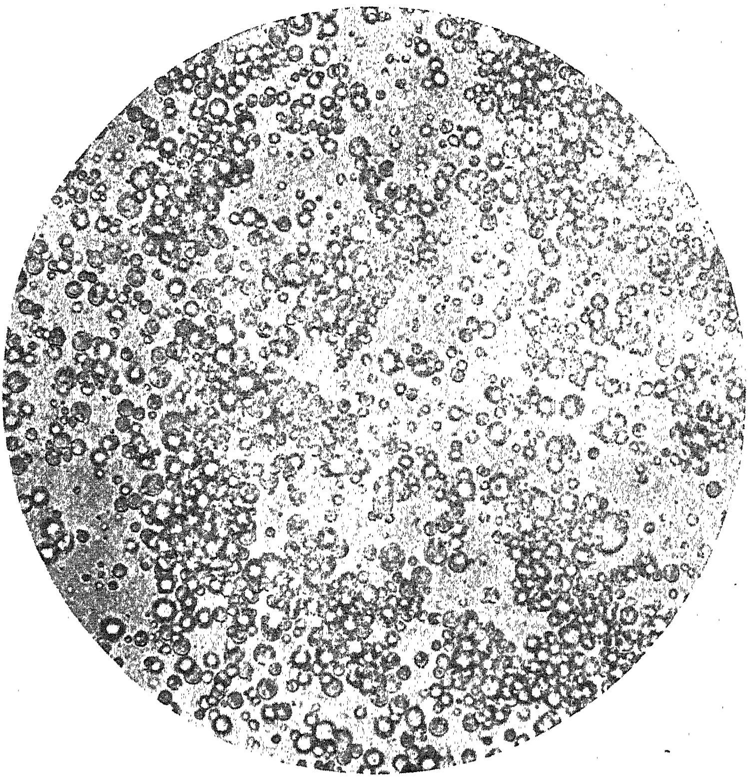

FIG. 11.—Dexter. Milk × 500 diam.

the milk and thus facilitates the de-emulsifying operation of churning.

The remaining factor which might influence churnability is the character of the fat-globules, and it is to this that we have more particularly turned our attention, with the results tabulated in the foregoing pages. We had hoped that, from the comparison between our figures and the tabulated results of the Butter Test supplied by Mr. Mathews, it would have

been possible to find a definite relationship between loss of fat in the separated and butter-milks and the character of the globules. Owing, however, to the fact that the weighing of the butter and the estimation of the quantities of fat lost in the separated and butter-milks are not sufficiently delicate to show the minute differences which might be expected between one breed and another, we cannot attempt to base any conclusions on such a comparison. In saying this, we

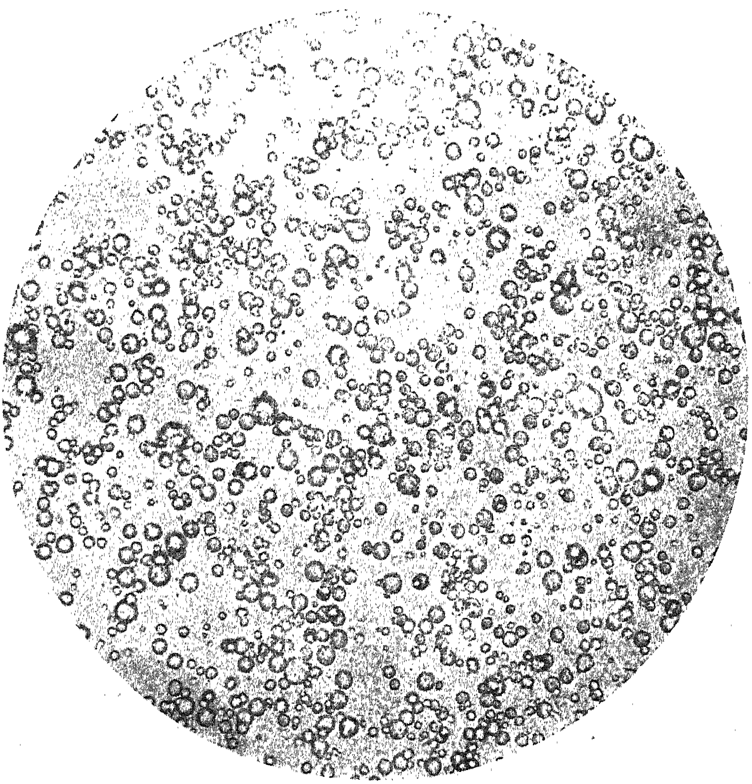

FIG. 12.—Gloucester. Milk × 500 diam.

do not suggest that it is in any way desirable that the conditions or methods pursued in the Butter Test Competition should be altered; the degree of accuracy, in our opinion, sufficing for all practical purposes. A feature of this experiment which is undesirable from our point of view, is the fact that the *mixed* milks of different cows are used, while it is usual to find reluctant churnability in the milk of a

single animal. We would suggest, therefore, that a sample of milk from a single animal, known to give a bad churning milk, if obtainable, should be carefully analysed and the results of the analysis compared with the analysis of a similar sample of good churnability.

Finally, we would say that the casual microscopic examination of a milk, with a view to the determination of the character of its fat-globules is, in our opinion, of little use, as deductions based upon visual observation only are apt to be erroneous. That this is so will be admitted if one attempts to classify the photomicrographs of the different milks in order of coarseness or fineness of globule and then compares the results with Table V.

If the photographs (Figs. 1-13) and the explanatory tables in the report from the Cooper Research Laboratory at Watford are carefully studied, the reader cannot but be struck with the excellence of the former and with the enormous amount of work bestowed on them and on the whole subject as disclosed in the latter. The photographs are, I believe, unique, as I am not aware that the milks of all the British Dairy Breeds of cattle have ever been taken on so large a scale, although D'Hont showed plates of the milks of several of the foreign breeds, and included with them the Jersey and the Durham.

Speaking for myself, I can never forget the interest that Messrs. Robinson and Nuttall took in the subject from the very commencement, and the consideration and courtesy with which they listened to my suggestions, and the kindly and willing help they have given me throughout.

To them and to Mr. W. F. Cooper I feel that the Society is much indebted.

In D'Hont's article on the fat globules in milk (see page 47), he divides the different breeds into three classes :—

"Breeds with small globules,"

"Breeds with medium globules,"

"Breeds with large globules,"

and he places the Jersey and the Durham (Shorthorn) among the breeds with large globules.

In Professor Sheldon's *Book of the Dairy*, the cream globules in Ayrshire milk are said to be smaller than those in Jersey milk.

In both cases the milks examined were probably the produce from a single animal, as the globules shown in the mixed milks of these breeds do not exhibit such marked differences.

If D'Hont's division be adopted, it would appear as if milk from the Lincolnshire Red Shorthorns is the only one that can be placed in the division of "breeds with large

globules," while all other breeds would fall under the classification of breeds with medium globules, the differences between the Jersey and Ayrshire milks being very trifling.

Looking back at the experiments carried out at the three Shows of the Bath and West of England Society referred to above, and also at the recent Show at Gloucester, and comparing the results with the aid and by the light of the observations

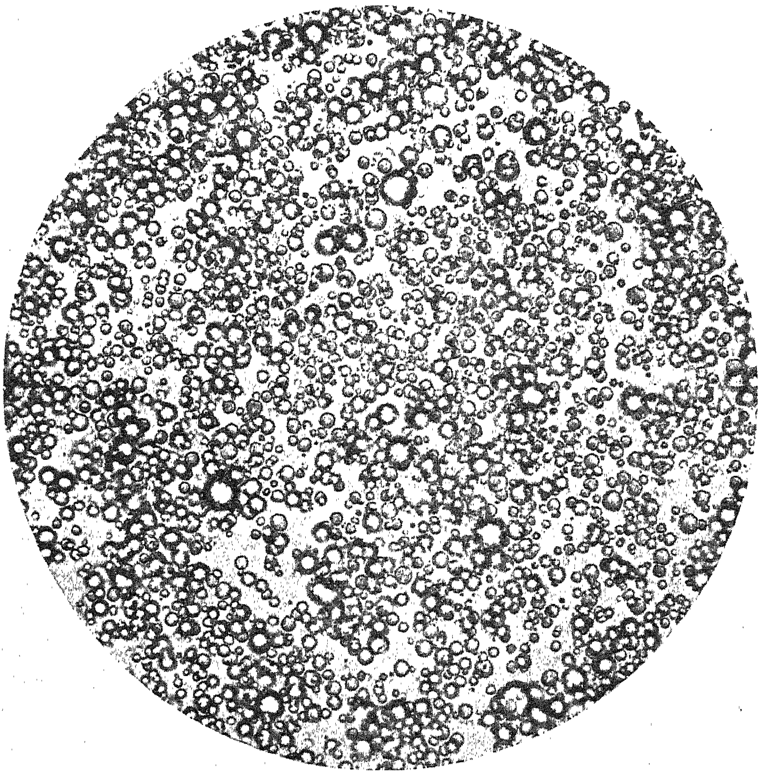

FIG. 13.—Welsh. Milk × 500 diam.

made at the Cooper Laboratory, Watford, I see no reason to alter the opinions previously formed, which may be summarised as follows :—

(1) That all things being equal, milks containing globules which in size do not range over too wide a field, and so may be described as regular or uniform, churn better than those which contain globules, varying from 12μ to 1μ.

(2) That the larger globules churn into butter sooner than the smaller ones, which pass away in the butter-milk.

(3) That in order to prevent this loss, special precautions should be taken in churning.

(4) That the mixing of milks of different breeds, if the dairy work is done properly, has no effect on the weight of butter produced.

The one exception brought out by this new investigation being that the variations in the sizes of the globules of the different breeds of cattle are not so marked as was formerly supposed to be the case.

It may be thought that too much has been claimed to have resulted from the butter-test and milk-yield trials.

With the exception of Dr. Sturtevant's article, I think it will be found that little, if anything, has been written on the special points that I have mentioned as having been brought into prominence by the butter-test trials.

That these trials in their infancy were thought much of by some, is shown by the fact that the great trials at Chicago followed the institution of those here, while the later elaborate trials carried out at St. Louis confirm one's opinions of the value set upon such competitions by the American breeders.

The excellent work done by the late Professor Speir amongst the Ayrshires is further proof, if any were wanting, of their utility.

The question of improving the milk-yielding capabilities of our dairy breeds is receiving much more attention than formerly, as may be seen from the reports of the experiments carried out by various Agricultural Colleges, notices of which are published by the Board of Agriculture.

The value of milk and butter-test records lies in this, that, if followed up in a practical manner, the manufacture of milk and of butter is carried out on the most economical lines.

Had this question of milk and butter-test records been made as much of in Ireland as co-operation in dairy work, I feel satisfied that the extra profits the farmers there now get for their milk through co-operation would have been still greater.

In closing a report of any dairy trials, it has been my habit to thank those stewards and assistants who have helped me. Two names have, however, been invariably omitted from the list, as I have always considered them as part and parcel of myself for the time being. I refer to Messrs. Hammond and Craufurd, the secretaries of the English Jersey Cattle Society, one, or both of whom, for the past twenty years, have worked with me in every test, and have always given me that kindly help and patience, without which trials such as these would have been much more difficult to carry out.

ERNEST MATHEWS.

Little Shardeloes, Amersham.

THE CITY DRAY HORSE.

IN the following article I do not in any way wish to champion the cause of any particular breed of draught horse, but to give some account of the various kinds of horses and their work in the great Lancashire and neighbouring centres of industry. I think it will be agreed that the draught horse as used in Lancashire, and especially in Liverpool, has scarcely an equal, I therefore hope that this article will, this year especially, not be entirely void of interest.

The various classes of horses required for heavy draught work are mainly of the Shire breed, except in some of the more northern cities where cross bred Shire and Clydesdale are used, and in a few cases pure Clydesdales. The horses in Liverpool, Manchester, and Leeds, and other great industrial centres of Lancashire and Yorkshire are practically all Shire bred, and are mainly from 16·2 to 17·0 hands high; massive short legged horses with abundance of hair and the necessary amount of weight to move the heavy loads to which they are put. Though weight is of the utmost importance, the city draught horse must possess perfect cart horse action to ensure activity and handiness. The hoof should be large, deep walled and properly shaped so as to stand the constant pounding on the hard surface of the city streets by powerful limbs, carrying a very massive body, otherwise injury will be done to the soft tissues or even to the bones that are enclosed within the foot, and once this happens a weighty horse seldom again works sound for any length of time. The greatest possible attention should be paid to the feet both when selecting and afterwards; weakness in this direction neutralising the great advantage of weight, and in fact making it detrimental. There is no truer axiom than "No foot, no horse," and his efficiency depends to a great extent on the manner in which he is shod. Each individual foot of every horse requires special treatment so as to leave the bearing of the foot as near as possible to what it would be in the unshod state; occasionally it is of course necessary to modify the hoof and bearing, as horses are subjected to many conditions which are purely artificial. The object of shoeing is to preserve all the parts of the foot in their natural conditions by allowing them to perform their own particular duties. Paring out the foot, so much loved by some farriers, has been responsible for many evils, but is luckily going out of favour.

Caulkings.—Another evil that horses have to endure in all the large towns is the use of caulking. The opinions on this subject of two of the leading veterinary surgeons in Manchester and Liverpool are well worth mentioning. Messrs. J. & A. Lawson (of Manchester) say, referring to caulkings: "Horses are undoubtedly better without them, but owing to the condition of the streets they are indispensable, but we consider they should only be long enough to ensure working with ease and not cocked up as a great many are at the present time." Mr. T. Eaton Jones, veterinary surgeon to the Liverpool Corporation, says: "In Liverpool all working cart horses are shod in this manner (with caulkings), for the simple reason that they would be quite unable to retain their foothold and perform the work required of them if they were shod flat. Horses are shod either with the rolled heel or with the straight heel, the rolled heel simply being the iron turned over, and the straight heel being a sort of straight spike let into the surface of the shoe. Usually both heels in front are rolled, with one straight heel and one rolled heel on each hind shoe. The straight heel is an additional precaution against slipping, as sometimes on very wide setts the rolled heel would not be of much service. [1] Spurns, of course, are also universally used in all big towns paved with setts."

The general consensus of opinion on this subject is that, in the cities where the blue "Penmaenmawr" setts are used, caulkings are an absolute necessity, but at the same time it is the greatest mistake to imagine that a high caulking gives a better grip than a moderately low one, and besides this, the strain to the horse's joints with the high caulking, is more severe than with the low caulking. Where Scotch granite setts are used, just heels and spurns are all that is required for the heavy loads which horses have to draw in the northern cities, where some foothold in addition to that of the ordinary flat shoe must be provided.

The pasterns, if properly sloped, will take up a great deal of the concussion to the foot and of the strain on ligament and joint. Short stilty pasterns with upright feet tend to increase the strain and jar, often leading to ringbone and other unsoundness fatal to city work. On the other hand the pasterns must not be too long nor the foot too flat. This latter formation is undesirable, as the extra leverage is apt to throw too great a strain upon the tendons, and generally upsets the balance of true conformation in the fore limb.

When walking, a long swinging stride is of the utmost value, but high pounding action is to be avoided. The hocks

[1] A "spurn," sometimes called a toe-piece, is a flat piece of iron about ⅝ in. wide and deep welded on to the road surface of the front part of the shoe.

should be kept moderately close together, should be lifted and not dragged behind, and should be brought forward with freedom and power, the whole movement of the limbs being perfectly straight and true. The city cart horse has often with one quick effort to throw his whole weight into the collar so as to move his load, which at times will get into the most awkward places, also when going up some steep siding, or round some specially greasy turning.

Though his total length is great he should have a short broad back, tremendous muscular development of quarter, and a powerful shoulder which should not be too slanting. We also like to see a massive neck, allowing collar room, which should be at the same time sufficiently long to allow of his reaching well forward to his work; the whole animal being well set off by a large well-shaped head.

The other breeds more in evidence further north are of the same type but are lighter in build, especially in the limbs, and lack the feather of the Shires.

The most popular colours are bays, browns, and blacks, with a few greys and roans; chestnuts, from the prevailing idea that they are not so hardy as the darker colours, are little favoured.

Supply.—The majority of the horses are imported from Lincolnshire, the midland counties, and north Wales, only a small proportion being bred in Lancashire, and those chiefly in the Fylde district. The horses bred by the farmers in the rest of the county are not, as a rule, weighty enough for heavy work in the large cities.

Regarding the breeding, the weightiest animals, and therefore, for city draught work, the best, are bred by Shire stallions out of Shire mares; the majority are probably by pedigree Shire stallions out of Shire bred mares which have not been considered worthy of entering, or which their owners have been too casual to enter, in the Stud Book. A large quantity of really good Shire stallions travel all parts of Lancashire and Cheshire at, in many cases, small fees of *2l. 2s.* to *3l. 3s.*, and serve a great number of these non-pedigree Shire and light cross-bred mares.

The best horses that are bred in Lancashire may be said to be produced by farmers holding land of 100 acres upwards. As a rule the small farmer does not trouble to breed, but buys second hand or young animals as he requires them. It may here be mentioned that owing to the somewhat inferior class of mares in central and south Lancashire, the animals produced are not, as a general rule, good enough to find their way to the big cities, but are bought by dealers and distributed over the country. In the Fylde district of Lancashire, where

Shire mares of a very high standard are kept and worked by the farmers (though perhaps the mares are not quite as good as they used to be), many of the finest Shire horses have been, and are still, bred. These horses undoubtedly find a ready market either through the dealers or at auctions in the great industrial centres, but unfortunately they are a small proportion of the total number of horses bred in Lancashire.

Rearing.—The city draught horses are not the produce of idle mares, for though some few of the very best geldings come from studs where mares are kept solely for breeding, these are the exception. Such animals are colts whose breeding would warrant their being left entire, but owing to some fault of colour or other imperfection they have not been thought suitable for the stud. It is most desirable, in the interests of dray horse breeding, that all but the very best and soundest horses should be castrated. The bulk of the supply of town horses are out of mares whose owners use them for ordinary farm labour, regarding the foals as an extra source of profit. The dams are usually worked to within a few days of foaling, and as a rule as soon afterwards again as possible, the foal being suckled as the case may require, and generally turned out with the mare to grass at night. The produce, both colts and fillies, are broken to work during the latter part of their second complete year, or say at eighteen months old, and continue to work on the land until four, or rising five, years old. Only very exceptionally is an animal, suitable for town work, offered for sale in the country after it has reached the age of five years.

The marketing of the young horses is done in three ways, viz., through dealers, public auctions, or fairs. The dealers visit the farms in their district and purchase horses of all ages from two years up to five years old ; two- and three-year-old horses are often left with the breeder or transferred to other farmers to work for their keep until they are ready for the towns, but the majority of the best horses are bought for town work through the auction sales at Wrexham, Crewe, Preston, Cockerham, and Derby, where they are taken in many cases by the dealers who have picked them up, as mentioned previously, or at the fairs, the chief of which are held at Chester, Welshpool, Newtown, Abergele, Lincoln, Horncastle, Doncaster, Preston, Appleby, Carlisle, Rugby, Newark, &c.

City work.—The management of the horses in the cities naturally varies according to the nature of the work required of them, but the following is that generally adopted. The number of hours worked averages about twelve per day, from leaving the stable at 6 to 7 a.m., the loads of necessity varying with the class of work they have to perform. The dock teams

of Liverpool, consisting of two horses, take anything from five to ten tons, including the vehicle, as an ordinary load, whilst the general load in the case of a four-wheeled city waggon, for one horse, varies from three to five tons. In Liverpool the draught horse is called upon to move the heaviest weights, Manchester and the other large towns following closely. The pace varies from two to three miles per hour.

The foods given, as might be expected, vary according to market fluctuations, but mainly the rations may be said to be as follows :—Maize, when the price permits, is by far the most largely used, mixed with a small proportion of beans, peas, or oats, but lately oats have been substituted for the maize owing to the high price of the latter, whilst chopped hay is of course the staple makeweight. For the heavy cart horse in full work about 30 lb. of this mixture is given daily.

The following examples of daily rations are of interest :—

Liverpool Corporation.

6 lb. Indian corn.
6 ,, Chilian oats.
4 ,, Beans.
1 ,, Oatmeal.
13 ,, Chopped hay, composed of half Canadian and half best English rye-grass and clover.

30 lb. per horse per day.

Messrs. Groves & Whitnall, Brewers, of Manchester.

Horses working in the town—

4 lb. Oats.
4 ,, Beans.
4 ,, Peas.
4 ,, Bran.
14 ,, Chopped clover and rye-grass.

30 lb. per horse per day, given in three feeds of 10 lb. each.

Horses working country journeys—

5 lb. Oats.
5 ,, Peas.
5 ,, Beans.
4 ,, Bran.
17 ,, Chopped clover and rye-grass.

36 lb. per horse per day, given in three feeds of 12 lb. each.

There will be a slight wastage in this last case, as the horses will feed out of nose-bags.

Messrs. Thompson, McKay & Co., Ltd., Carters to the Great Central Railway Company, Manchester.

5 lb. Crushed oats (English).
$1\frac{1}{2}$ „ Crushed barley (Russian).
$6\frac{1}{2}$ „ Crushed maize.
$2\frac{1}{2}$ „ Crushed beans.
$2\frac{1}{2}$ „ Bran.
14 „ Chopped clover and rye-grass.

32 lb. per horse per day.

The average length of working life of horses in the large cities in the case of corporations, railway companies, breweries, and other firms always having a similar class of work, is from four to seven years, according to the work performed; with smaller firms, such as master builders, &c., where the horses can be changed to light work, they last longer, nine years being the average life.

The disposal of the horses, after they have been employed so long at street work as to become unsound, or at any rate unsuitable for the very strenuous labour which such work entails, must vary with each individual case. The best class of animals are, in many cases, purchased by the smaller horse-keepers in the towns. It is a very regrettable fact that often in the case of mares, after they have been thoroughly worn out by this second term of town work, they find their way back to the small farmers who live in the districts surrounding the large cities. About half of these are used by farmers as breeding stock, a very deplorable state of affairs, for the exhausted frame of such an animal cannot be expected to rear strong and vigorous stock. The geldings are used in the country for any work they are fit to perform on the land or even for light work on the road. There exists in most towns a public auction yard at which this class of animal is offered, the prices varying from 10*l.* to 18*l.*

The demand for the draught horse has certainly not been in any way affected by the introduction of motor vehicles, and unless the present system of mechanical traction is altered and improved, I cannot see that there need be the least apprehension regarding the future market for the best classes of British cart horses. The majority of firms that introduced motor vehicles have found it necessary to replace a number of them with dray horses. The heavy motor waggons at present in vogue are doing the quick work on distances that railway companies have up to the present been unable to deal with expeditiously, but for short distances, getting into awkward places, on greasy paved streets or on soft land, the motor vehicle is unsatisfactory. Added to this the enormous initial

expense, the heavy cost of upkeep, and the rapid depreciation, make it impossible for mechanical traction, in the case of heavy draught, to compete successfully with the dray horse.

In conclusion, I wish to thank Mr. T. Eaton Jones, M.R.C.V.S., and Messrs. J. & A. Lawson, M.R.C.V.S., of Manchester, for their kind and valued assistance in supplying me with material for this article.

STUART HEATON.

Worsley, near Manchester.

THE PHYSIOLOGY OF STOCK-BREEDING.

BY FRANCIS H. A. MARSHALL, M.A. (CANTAB.), D.SC. (EDIN.),
Fellow of Christ's College, Cambridge, and University Lecturer in Agricultural Physiology.

THAT the study of chemistry has an important bearing on agricultural practice is now universally admitted. That the science of botany has an equally close relation to all kinds of plant culture is regarded as too obvious to call for comment. It is a little remarkable, therefore, that the claims of physiology to be applied to problems of stock-raising receive comparatively little recognition, and that this branch of biological study often finds no place in an organised agricultural curriculum. It cannot be contended that the physiology of breeding is a department of veterinary rather than of agricultural knowledge, because this subject in the veterinary text-books (as indeed in most other works on physiology) is either passed over entirely, or else is relegated to a few final pages seldom free from error. Yet no one who has paid attention to the phenomena attending generation in animals can doubt that these ought to possess as close a relation to the methods of stock-breeding as that which subsists between the facts of chemistry or botany and the modern practice of agriculture. Writers on agricultural questions have laid little stress on this point, yet Mr. Walter Heape, who has studied the subject closely, affirms in a work on the national importance of the breeding industry,[1] that in his opinion "it is the loss which is incurred in consequence of ignorance of these matters, [*i.e.*, the phenomena attending the function of reproduction,] which weighs and retards the industry, which reduces the profits, swallows up the bonus, and prevents breeding from occupying, as it should occupy, a foremost place on the credit side of the national balance sheet."

[1] Heape: *The Breeding Industry.* Cambridge, 1906.

No apology is needed, therefore, for publishing in an agricultural journal an article dealing with the bearing of recent physiological observations upon the practice of animal breeding. But in order to render these intelligible to the reader, it is necessary to go over old ground, to restate various fundamental facts which are sometimes lost sight of, and incidentally to revise certain conclusions which often pass current at the present time.

OVA AND SPERMATOZOA.

The development of every animal (at least among the higher forms of life) is initiated by the conjugation of a female germ cell or ovum with a male germ cell or spermatozoön. The product of union or fertilised ovum in virtue of this act of conjugation is endowed with a new vitality, whereby it is rendered capable of undergoing that long series of cell divisions which culminates in the complete development of a new individual, bearing a more or less close resemblance to the sire and dam, from which the spermatozoön and ovum were respectively derived. In the act of copulation the spermatozoa, which swim freely in the seminal fluid of the male, are injected through the penis into the female genital passages (vagina and uterus). In the ram, as I have shown elsewhere,[1] the penis is provided with a long tubular filiform appendage composed largely of erectile tissue, and through this prolongation the spermatozoa must pass before being ejaculated. This fact is taken advantage of by ram traders when wishing to discard tups for breeding purposes. The filiform appendage is removed before the ram is sent to market. Many novices have been deceived by this practice, called "worming"; for such sheep are bought by unscrupulous dealers, in open market, who pass them on to the unwary as sound sires, though they themselves have only paid a "butcher's" price for them. The erectile character of this structure would seem to indicate that it is inserted into the mouth of the uterus (womb or "bed") so as

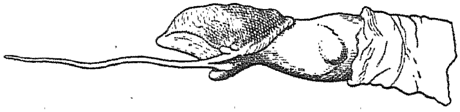

FIG. 1.—Terminal portion of ram's penis showing filiform prolongation. (About ⅔ natural size).

to ensure the passage of the spermatozoa into that organ, and not merely into the outside chamber or vagina. It is clear, therefore, that any injury to this somewhat delicate penile appendage may impair the fertility of the ram.

[1] Marshall: "The Copulatory Organ in the Sheep," *Anatomischer Anzeiger*, Vol. 20, 1901.

The spermatozoa are produced in enormous quantities in the testes, and in most of the domestic animals the process of formation appears to go on almost continuously. The production of ova, on the other hand, is limited, both in regard to the periods of ripening and the number that are matured. For in the female ovulation, or the discharge of ripe ova from the ovaries, is restricted to the periods of œstrus, and even at these times the number of ripe ova produced is, on an average, scarcely, if at all, greater than the normal number of young born in a litter.

The complete œstrous (or female generative) cycle consists of periods of rest alternating with periods of activity or "heat" periods. The latter, as was first pointed out by Heape,[1] consist of two sub-periods. The first of these is the pro-œstrum, during which the generative organs become congested, and external bleeding associated with a discharge of mucus from the genital apertures sometimes takes place (notably in dogs). This generally lasts for only a day or two, but in dogs may extend for a week or ten days. It must be regarded as an act of preparation on the part of the generative organs, and more particularly the uterus, for the reception of a fertilised ovum, for at this period the superficial tissues of the uterine mucous membrane (which lines the cavity) undergo a process of renewal.[2] The pro-œstrum is followed by the œstrus (or second sub-period) which may be regarded as the "heat" period proper. It is then only that the female is normally ready to receive the male, and ovulation takes place. The duration of the œstrus is somewhat variable, a mare occasionally remaining on "heat" for as much as a week, but this is unusual. One or two days is a more ordinary time, but a ewe may sometimes be in a condition to receive the tup for only a few hours. It is important to remember that ovulation cannot as a rule occur at other times than the œstrous periods, and that sometimes it may be delayed until near the end of the œstrus. Consequently a too early service during heat may result in barrenness, simply because at the time when the female received the spermatozoa there were no discharged ova for them to fertilise.

The number of ova which are discharged at a single œstrus, as already remarked, appears to bear a close relation to the normal number of young produced at a time. In the cow, so far as I

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[1] Heape: "The Sexual Season," &c., *Quart. Jour. Micr. Science*, Vol. 44, 1900. See also Marshall: "The Œstrous Cycle, &c., in the Sheep," *Phil. Trans. Royal Soc.*, B, Vol. 196, 1903.

[2] The pro-œstrous changes may however be so slight as to be unrecognisable externally, and yet a normal œstrus may supervene. Owing to this some "cowmen" will let a "period" pass by and so lose three weeks, and possibly the chance of getting an animal in calf for that season, simply because they failed to detect any pro-œstrous discharge.

have observed, only one ovum is usually discharged at ovulation, this being apparent from the single ruptured follicle[1] remaining in one of the ovaries. In the mare also, it is usual for only one follicle to rupture at a time, though of course, in both these animals, twins are occasionally produced. In the sheep, however, in which twins and triplets are not uncommon, I have frequently found two and sometimes three recently discharged follicles in the ovaries during the tupping season, but even in this animal a single discharged follicle is, in my

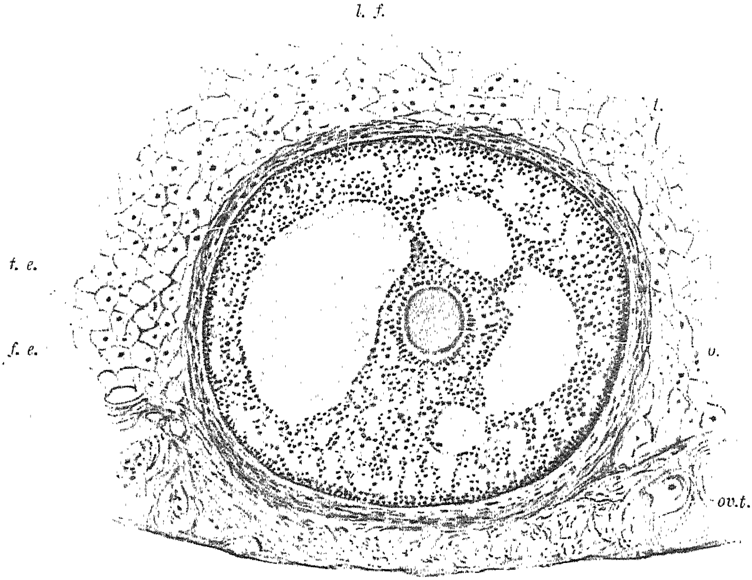

FIG. 2.—Section through Graafian follicle of ovary (highly magnified). *c. t.*, connective tissue forming outside wall of follicle; *f. e.*, follicular epithelium; *l. f.*, liquor folliculi occupying cavity; *o.*, ovum; *ov. t.*, tissue forming ground substance of ovary.

experience, more usual, especially among hill sheep. In view of these facts it is clear that the ewe is a more important factor in twin production than the tup, for whereas the number of ova ready for fertilisation at a heat period is very limited, the number of spermatozoa is innumerable. I have seen spermatozoa present within the lumina or hollow cavities of the uterine glands and along the edge of the uterine cavity in extraordinary abundance on the day following service, so that it seems inconceivable in such cases that any ova entering that organ could escape fertilisation through a deficiency in the number of spermatozoa.

[1] The little sacs or bags which contain the developing ova in the ovaries are called Graafian follicles (see Fig. 2).

The vitality of spermatozoa varies in different species. In the rabbit I have found living spermatozoa in the male passage ten days after castration, but they have not been kept alive outside the body for so long a time. By maintaining a temperature equal to that of the body, and after adding normal salt

FIG. 3.—Spermatozoön of ram (very highly magnified.)

solution or Ringer's fluid to the semen, I have succeeded in keeping spermatozoa alive for twenty-four hours, but not for a longer period. Iwanoff,[1] of St. Petersburg, has been successful in artificially inseminating mares after keeping the stallions' spermatozoa for a short time in various artificial media, the mares becoming pregnant and producing normal foals. These experiments are not without interest, in view of the fact that the artificial injection of semen into the vagina or uterus of female animals is now extensively practised, being found especially useful as a means of overcoming certain forms of barrenness, such as those arising from a constricted entrance to the uterus, or the presence of an abnormal acid vaginal secretion which has the effect of killing the spermatozoa before they can effect an entrance into the uterus. Whether spermatozoa are capable of living for as long a time in the female genital passages as in the male, is a point which has never been determined (at least for the domestic animals). It may, however, be pointed out that while these organisms are retained in the male they are in a condition of relative quiescence, and that there are reasons for believing that they do not become actively motile until ejection; and moreover that a state of constant motility is unfavourable to a long continued existence unless there is some means of renewing the supply of energy, and of this there is no evidence in the case of living spermatozoa.

FACTORS IN FERTILITY.

Although only a small number of ova—and often only one—are sufficiently mature to be discharged from the ovaries at any one period of œstrus, the total number of unripe ova existing in those organs is very large, but most of these are in a very immature condition. Each ovum is contained within a follicle or vesicle, and the follicles vary in size and position in the ovaries according to their degree of development; the smallest lie close to the surface, but as they grow bigger they pass inwards, while the largest follicles, on the other hand, protrude visibly from the surface, and each one occupies a

[1] Iwanoff: "De la Fécondation Artificielle chez les Mammiferes," *Arch. des Sciences Biologiques*, Vol. 12, 1907.

considerable part of the ovary. The large follicles are provided with a quantity of nutrient fluid containing protein[1] substances in solution. This fluid serves to nourish the developing ovum to which it is transferred by a layer of cells immediately surrounding it. These cells are known as the follicular epithelial cells. The largest follicles are the ripest, and these protrude perceptibly from the ovaries preparatory to discharging the mature ova in the act of ovulation.

Not all the follicles in the ovaries reach maturity. A number (which probably vary considerably in different individuals) degenerate during development, some at one stage and

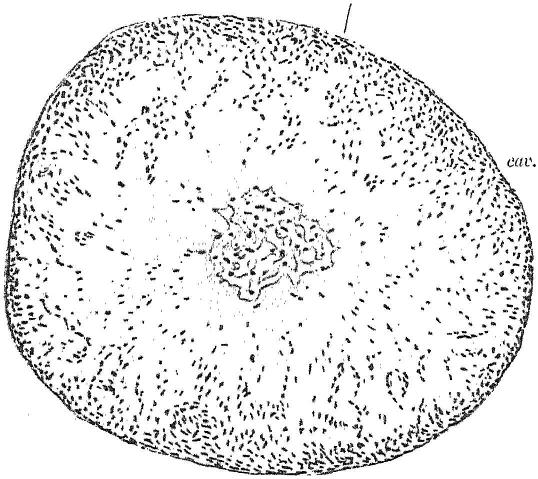

FIG. 4.—Section through degenerate follicle (highly magnified).
The ovum and follicular epithelium have become disintegrated and the cavity (*cav.*) is in process of being filled by a loose ingrowth from the connective tissue wall (*c. t.*).

some at another. Even the very young follicles not infrequently atrophy, but the cause is difficult to determine. Heape has shown[2] that in the rabbit the process of degeneration may sometimes begin with the ovum, and sometimes with the follicular epithelial cells, but the final result is the same, for the ovum cannot survive after the cells which supplied it with nourishment have become disintegrated and functionless. In the sheep so far as my own observations go, degeneration is most liable to set in when the follicles have reached from about one eighth to one half of the size of the mature follicle. The

[1] Proteins are complex nitrogenous substances which in one form or another go to make up a very large portion of the animal body. They are particularly well represented in flesh or meat, and so may be described roughly as flesh-forming substances.

[2] Heape: "Ovulation," &c., *Proc. Royal Soc.*, Vol. 76, 1905.

process is interpreted as an indication that the follicles and consequently the contained ova were not receiving a sufficient supply of the right kind of nourishment. As the follicle in the ovary has been developing for some time previously to the rams being "turned in," and as it is apt to be interfered with by want of proper feeding, a warning may here be taken by those who do not keep their ewes sufficiently well 'twixt "weaning" and "tupping-time." This period is always looked upon as a cheap-keep time for the flock, and some shepherds go as far as to say that it is essential to thoroughly "starve the milk out of them" before "springing" or "flushing" the ewes ready for ram service. Hence it may with advantage be pointed out that knowledge of the physiology of reproduction teaches that this cheap-keep time may be overdone. While it is eminently desirable that the ewes should not get too fat, it can be seen they should be fed well enough to nourish the developing follicles. In very fat animals (cows and heifers) I have found follicles of considerable size in a condition of degeneration, and in such cases their occurrence is very possibly to be correlated with the sterility, either partial or complete, which is known so often to affect stock that have been fattened. However this may be, it is obvious that if a sufficiently large number of follicles and ova have undergone degeneration, and at whatever stage in their development this process may have taken place, it must inevitably result in a reduction of fertility. That an insufficiency of the right kind of food supply or a state of disease should produce a disturbance in the ovarian metabolism[1] is only to be expected on physiological grounds, but that a similar result should be brought about by a rich fattening diet is at first sight not obvious. It is well known, however, to all those who have studied the subject that the generative organs are peculiarly susceptible to altered conditions of existence, not only as regards food supply, but also as regards the surroundings generally, and that a change in the environment may often induce a condition of sterility.

Breeders are generally agreed that sheep which are in an improving condition rather than a condition of fat at tupping time are likely to produce a good crop of lambs, and that certain stimulating foods fed for a few weeks before breeding but afterwards discontinued have a favourable effect upon the fertility. In the case of Scottish sheep the truth of this assertion has been definitely proved by statistics.[2] Moreover, it is

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[1] The changes undergone by the living tissues of the body are grouped together under the term "metabolism."

[2] Marshall: "Fertility in Scottish Sheep," *Trans. Highland and Agri. Soc.*, Vol. 20, 1908.

only what the physiologist would expect, for the number of lambs born must depend upon the number of ova discharged at periods of œstrus. Again there can be no doubt that a stimulating diet favours the development of follicles, and so provides a larger number available for discharging the mature ova at the time of tupping. Such a diet administered at any other season is not so likely to increase the fertility, because the condition of the follicles in the ovaries is one of immaturity (excepting in those varieties which can breed constantly), and unless the "flushing" is continued until tupping time the number of ripe follicles present at any single heat period is less likely to be increased. Moreover, there is evidence that heavy flushing when succeeded by a mere sustenance diet is conducive to a degeneration of follicles, and so is liable to impair the fertility of the sheep in subsequent years.

It has been claimed by German veterinarians that the drug yohimbine, if administered to domestic animals, often acts as a remedy for impotence and sterility. That it can cause a very marked congestion of the entire generative tract in rodents has been shown by Dr. Cramer and myself.[1] More recently I have obtained evidence that yohimbine acts directly on the tissues, since it can produce congestion of the uterus. Furthermore it appears to favour the maturation of follicles and to prevent follicular degeneration, but more evidence is required on this point. It would seem clear, however, that by increasing the blood supply to the ovaries it must provide these organs and the developing ova which they contain with a more abundant nourishment, and so favour an increased fertility. This is probably (in part at least) the physiological explanation of the results obtained by veterinarians and others in Germany. At the same time there can be no doubt that this drug produces a marked aphrodisiac action, that is to say it increases sexual desire, producing this effect both in males and females.

Selection among Germ Cells.

Besides fertilising the ova, the spermatozoa have the function of transmitting the hereditary characters of the male parent. In a similar way the ova are the bearers of the maternal characters. There are many reasons for concluding that the parental characters are not distributed equally among all the ova or spermatozoa, and modern Mendelian research has afforded much evidence in favour of the theory that there is a definite segregation by which the carriers of alternate or different characters pass into different germ cells. Heape and others have recently suggested that there is a struggle for existence among

[1] Cramer and Marshall: "Preliminary Note on the Action of Yohimbine on the Generative System," *Jour. of Economic Biology*, Vol. 2, 1908.

the germ cells just as there is among wild animals, and that the ova which degenerate during the process of development are such as are not fitted to their surroundings, or do not receive a suitable form of nutrition in the ovary. In this way he explains the apparent fact which is based on statistics of births for dogs and other animals, that some conditions favour the production of males and others of females. Heape suggests that sex is already differentiated in the ova, and that under certain circumstances a larger number of ova of one sex become mature, and that as a consequence there are a greater number of offspring belonging to that sex. In a similar way he would explain the frequency of other sorts of variation. It ought to be possible, therefore, in certain cases to discover the conditions which determine the production of one kind of individual rather than another, the idea being that the external conditions affect the ovarian metabolism, and that only those ova which happen to be fitted to the nutritive conditions which prevail in the ovary are able to survive. If this conclusion is correct—and the evidence brought forward is considerable—an enormous field of work is opened up.

There is also evidence that the law of selection operates among spermatozoa. For, as already mentioned, only a very small proportion of the spermatozoa that are ejaculated are able to conjugate with ova, and it is *prima facie* improbable that every spermatozoön has an equal chance in the struggle for existence. Moreover, it is well established that whereas some males may be sterile with individual females, they may be perfectly fertile when serving other females. For example, it is said that Dorset Horn ewes are not infrequently barren when served by tups of their own breed, but are capable of becoming pregnant when served by a Hampshire Down tup.[1]

Some years ago I carried out an experiment which probably has some bearing on this point. I took a Dandie Dinmont bitch and a Dandie Dinmont dog, which was some relation of the bitch, and also an ill-bred Bull Terrier dog. I obtained seminal fluid from each of the two dogs, and examined samples under the microscope to satisfy myself that the spermatozoa were alive. I then mixed together equal quantities of the semen of the two animals, and finding on further examination of a sample of the mixture that all the spermatozoa were still active, I injected the semen into the vagina of the Dandie Dinmont bitch, which was at that time on heat. The bitch was isolated until all signs of œstrus had passed off. A few weeks later it was evident that she had conceived, and at full time she

[1] Heape: "Abortion, Barrenness, and Fertility amongst Sheep," *Jour. Royal Agric. Soc.*, Vol. 10, 1899.

gave birth to four pups which were all closely alike. One of these unfortunately died whilst still very young, but the others grew up into obvious mongrels, showing little resemblance to the Dandie Dinmont dog from whom half of the injected semen was obtained. It is, of course, scarcely legitimate to draw conclusions from a single experiment, but the result is suggestive of a selective action on the part of the ova.

Experience has shown that inbred animals often tend to be infertile, especially when mated with individuals that are also inbred and of the same kind, and this is probably due to a decreased tendency on the part of the germ cells to conjugate, comparable to that which is known to occur under certain conditions among unicellular organisms or protozoa. Moreover, among inbred animals it is well known that there is often a reduction in the general vitality as manifested, for example, by a decreased resistance to disease. It would seem extremely probable, therefore, that when two inbred animals are mated together, the sum of the vitality of the ova and spermatozoa may be insufficient to admit of conjugation, but that if the spermatozoa are produced by a more vigorous stock, they may succeed in fertilising the inbred ova.

Experiments by Calkins[1] and others on the physiology of reproduction among the lowest forms of animal life have shown that the deterioration which results from close inbreeding may in some cases be obviated by a change of food or surroundings, and that by resorting to such means strains which would otherwise die out may survive to reproduce future generations. So also among the higher animals it would seem as if a complete change in the environment may sometimes lead to as favourable a result as an infusion of entirely fresh "blood." Thus Allison, the special commissioner of the *Sportsman*, writes as follows about thoroughbreds imported into Australia :—"We can draw from these not only strains of blood which we have lost, but horses and mares, born again so to speak, and admirably suited to strengthen and regulate our home stock."[2] Breeders of game-fowl in the day of the "cock-pit" were very great advocates of in-breeding. All reference to their methods speak of their practice in this respect. They had an idea, however, that in order to prevent any ill effect from this consanguineous mating, it was desirable to send their cockerels from home to be reared. It is said that south country and midland breeders would send their young birds to be "walked" in the north of England. It is true that this practice had a double effect. The cockerel sent away as a

[1] Calkins : "Studies on the Life History of Protozoa," *Jour. of Experimental Zoology and Biological Bulletin*, 1907.

[2] Allison : *The British Thoroughbred Horse.* London, 1901.

chicken often did not return to the owner's yard till he was a second season bird. He might then very likely be mated with first season pullets, which would not be quite so near to him in blood as if he had been paired with birds of his own year; possibly those out of the same clutch as himself. But anyhow, the belief among the old-fashioned "cockers" in the advantage of change of environment was great.

Ovariotomy and the Secretory Functions of the Ovary.

Besides providing the germ cells—ova and spermatozoa—the ovaries and testes serve the function of organs of internal secretion, and in this capacity exert an influence on the general bodily metabolism. The nature of this influence is best shown by the results of castration and ovariotomy, in which operations the essential organs of reproduction are removed.

That castration in the male if performed before puberty arrests the development of many of the secondary sexual characters is well known. Thus, in horned sheep, after removal of the testes in early life, the shape of the horns is similar to that of the female. If, however, castration is delayed until after sexual maturity has been reached, and the secondary male characters have been acquired, the changes produced are far less pronounced. In a similar way animals which are castrated young do not experience sexual desire, but this result does not necessarily follow if the operation is carried out later in life.

The erection of the penis in all animals is a complex action, partly muscular and partly nervous, under the control of a centre located in the hind part of the spinal cord, from which impulses are transmitted to the organ in question by certain nerves called by physiologists the nervi erigentes. On stimulating these nerves artificially by an electric current, the penis can be caused to erect experimentally. Dr. Sutherland Simpson and I have shown[1] that in animals that have been castrated previous to puberty, stimulation of the nervi erigentes, if carried out after adult age has been reached, does not produce erection, thus showing that in the absence of the testes, the mechanism of erection is not developed.

If in the female ovariotomy or the removal of the ovaries be performed after sexual maturity has been reached, the uterus undergoes a gradual atrophy; if the removal be carried out before puberty, the uterus remains infantile or undeveloped. Mr. Carmichael and I have shown that on the other hand, if

[1] Simpson and Marshall: "On the Effect of Stimulating the Nervi Erigentes in Castrated Animals," *Quart. Jour. Exper. Phys.*, Vol. 1, 1908.

the uterus be removed, whether before or after puberty, it has no effect upon the development or functional activity of the ovaries, although it is obvious that under such a condition pregnancy can no longer occur.

Furthermore, heat cannot be experienced after complete ovariotomy, the œstrous cycle thereby ceasing. In those cases in which œstrus is reported to have taken place after the extirpation of the ovaries, its occurrence is probably to be explained by supposing that a portion of one of the ovaries was accidentally left behind at the time of the operation. Experiments have shown that in rabbits and other animals, a small fragment of ovary may regenerate into one of quite considerable size in the course of a few months, and that after the removal of one ovary the remaining one can undergo a process of compensatory growth. It is clear, therefore, that the power of functional restitution possessed by these organs is by no means slight. Moreover, there are cases on record of the occurrence of pregnancy after the supposed removal of the ovaries, thus showing that the operation had been incomplete, and that regeneration had followed.

The removal of the uterus and oviducts (*i.e.*, the tubes which convey the ova to the uterus) does not prevent the occurrence of heat, but in some cases the indications of pro-œstrum are less marked, since there can be no uterine bleeding. Our experiments have shown however that subsequent to the removal of the uterus from rabbits during early life, the animals experienced sexual desire after reaching maturity, and copulated normally, and that the follicles in the ovary were discharged at such times, ova being simply expelled into the body cavity.

Ovariotomy, like castration in the male, frequently results in a deposition of fat in various parts of the body, but whether this is a direct consequence of the removal of the generative organs upon the metabolism, or an indirect result due to the increased lethargy of disposition which so often follows the operation, is still an open question. Hobday[1] has shown that ovariotomy may be a useful expedient for unworkable or troublesome mares, and that vice may thereby be cured, especially where it is associated with a prolongation or too frequent recurrence of œstrus. With young sows, in certain localities, it is a regular practice to remove the ovaries to prevent heat and to assist the animals to fatten. I am informed that it is also common to remove the uterus for the same purpose, but this operation is superfluous, since extirpation of that organ, although sufficient to induce sterility, does not inhibit pro-œstrum and

[1] Hobday: "On Ovariotomy in Troublesome Mares," *Veterinary Jour.*, Vol. 62, 1906.

œstrus unless the ovaries be also removed. Further, unless the extirpation of the ovaries be complete, compensatory growth may take place, and heat may recur associated with the usual outward indications. The same criticism may be made about the practice of "webbing," which, according to Wallace,[1] is a method of de-sexing cattle, prevalent in certain parts of Australia. In this operation the oviducts are drawn on one side so as to destroy their normal anatomical relation to the ovaries, and prevent them from receiving the ripe ova that are discharged at ovulation. Such a method cannot inhibit the cyclical recurrence of heat, since this depends upon the functional activity of the ovaries which are apparently left intact, but webbing is no doubt a very efficient means of preventing conception. So also with fowls; hens cannot be properly de-sexed or converted into true "poulardes" by merely withdrawing a portion of the oviduct, although this operation may effectively prevent the secretion of albumen which accompanies egg laying, and so possibly be a factor in fattening and general growth.

The influence of the ovaries upon the other organs and tissues is chemical rather than nervous in nature. This conclusion has been established by experiments on dogs, rats, and other animals, in which the ovaries were removed from their normal positions and transplanted mid-ventrally on to the wall of the body cavity or into the tissues of the kidneys. In such cases the ovaries, although deprived of their ordinary nervous connections, still continue to exert an influence upon the uterus, which instead of undergoing atrophy, passes through the usual cyclical changes.[2] It is supposed, therefore, that the ovaries elaborate one or more internal secretions which have a specific action upon the uterus, and a definite influence upon the whole metabolism. In the same kind of way evidence has been adduced that the testes elaborate internal secretions which influence the male metabolism. It is believed that these ovarian and testicular secretions circulate in the blood throughout the entire body, their presence being correlated with the characteristics of sex.

The functional relation between the ovaries and uterus is, however, an especially close one. As already stated, the uterus atrophies after ovariotomy. The growth and congestion which the uterus undergoes during pro-œstrum is synchronous with an increased activity on the part of the ovaries, as manifested by the production of mature follicles at this period. Moreover the more excessive hypertrophy and vascularisation which

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[1] Wallace: *Farm Live Stock of Great Britain.* Edinburgh, 1907.

[2] Marshall and Jolly: "On the Results of the Removal and Transplantation of Ovaries," *Trans. Royal Soc., Edinburgh*, Vol. 45, 1907.

characterise the uterus during the earlier part of pregnancy is associated with the formation of bodies called corpora lutea in the ovaries. For after ovulation and when the ova have been discharged the follicular epithelial cells, instead of degenerating, undergo an enormous increase in size and become converted into luteal cells, so called because they contain a yellow pigmented substance known as lutein. These luteal cells fill up the cavity of the discharged follicle which is thus converted into

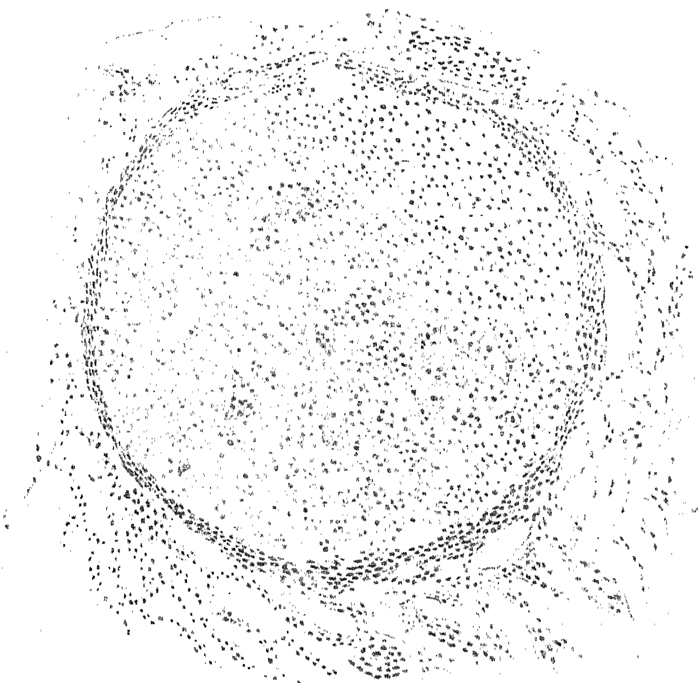

FIG. 5.—Corpus luteum or discharged follicle in ovary after transplantation into kidney.

l.c., luteal cells filling cavity; *c.t.*, connective tissue wall of follicle; *k.t.*, tissue of kidney.

a corpus luteum. If pregnancy supervenes as a result of conception during œstrus, these corpora lutea continue to grow until nearly half way through that period, when they gradually degenerate, but if the animal fails to become pregnant they go on increasing in size for only a few days and then dwindle. The fully formed corpus luteum is provided with a rich blood supply, and has all the appearance of an internally secreting gland.

Experiments upon various animals (rabbits, dogs, &c.), by Fraenckel,[1] Dr. Jolly, and myself,[2] and other investigators have shown that if the ovaries with their contained corpora lutea are extirpated in the earlier stages of pregnancy, abortion occurs. If a sufficient quantity of luteal tissue is left behind, one or more of the developing embryos may escape abortion. It is assumed therefore that the corpora lutea contribute an essential factor in the nutrition of the embryo, and are probably necessary for those hypertrophic changes whereby the wall of the uterus prepares itself for the reception of the fertilised ovum.

Since corpora lutea are derived only from discharged follicles, the amount of luteal tissue present in the ovaries must depend upon the number of follicles which ruptured at ovulation. And since the presence of luteal tissue is a necessary factor in the development of the fertilised ovum, it would seem to follow that there is a causal relation between the number of follicles that discharge at ovulation, and the provision made by the uterus for the developing embryos. A statistical investigation upon fertility in Scottish sheep showed that among flocks which were submitted to flushing or extra feeding at tupping time, not only was the fertility greater, but the frequency of abortion was less. The latter result may have depended upon this correlation between the ovarian and uterine functions, since the stimulation of the ovarian metabolism at tupping time must have resulted in the formation of a greater quantity of functional luteal tissue.

It is, of course, undeniable that sporadic (as distinguished from contagious or epizoötic) abortion is often induced by accidental causes such as physical strain or sudden fright, but it is equally true that some individuals are more liable to be affected than others. Some fortuitous circumstance may be the immediate cause of an animal "slipping" young, but it is no explanation of the tendency towards abortion, a tendency which may be greater at some times than others. The physiological conditions which favour abortion are still only imperfectly understood, but one fact may be regarded as established, namely, that the state of pregnancy depends not only for its initiation, but also for its continuance (at least in the earlier stages) upon the functional activity of the ovaries.

As already stated, flushing sheep or giving them additional feeding during the tupping season is a means of increasing the fertility of a flock at lambing time. So also it has been found that the same process hastens forward the time of tupping. It

[1] Fraenckel: "Die Function des Corpus Luteum," *Arch. of Gynäk.*, Vol. 68, 1903.

[2] Marshall and Jolly: "Contributions to the Physiology of Mammalian Reproduction," *Phil. Trans. Royal Soc.*, Vol. 198, B. 1905.

would seem, therefore, that the additional feeding promotes ovarian secretory activity, and so is an important factor in the recurrence of the œstrous cycle. In a similar way the drug yohimbine, by providing the ovaries with a rich blood supply, and so increasing the ovarian metabolism, may be supposed to favour the formation of the internal secretion which is one of the exciting causes of heat.

Conversely, an excessive food supply which promotes fattening has a retarding influence on the elaboration of the ovarian internal secretion. Animals which have been fattened often come on heat very irregularly. This condition not only favours the degeneration of follicles, but it also interferes with the ovarian metabolism in other ways. Thus I have found in fat cows and heifers, associated with a great deposition of fat around the generative organs, a quantity of yellow lipochrome present in those cells of the ovaries which are believed to be normally responsible for producing the internal secretion.

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THE COST OF WINTER GRAZING IN EAST NORFOLK.

IN East Norfolk, as in East Anglia generally, the word grazing does not imply feeding on pasture only as is the case elsewhere. The winter grazing of bullocks in East Norfolk is carried on as follows. Stores are bought in the autumn, chiefly at the Saturday market on Norwich Hill, they are then usually turned out for a few days on to an "olland" (as the aftermath is called locally), pasture or marsh, where they are broken to turnips. They are then got into yards, sheds, or boxes, where they are fattened off on concentrated foods and the usual plough land produce.

The ideas of feeders differ as to the quality and quantity of concentrated food to give, and also as to the chopping or shredding of the roots, and the use of long hay, hay chaff, or cut straw. Pulped roots are said to go farthest, but *hand chopping* is most popular, and the rapidity and dexterity with which this tedious operation is performed by the bullock tender is marvellous. A practical hand can, with a short sickle only, slice up 176 bushels of roots per day for six months, working seven days a week, attending to the wants of forty-four beasts, and receiving 15*s.* per week for his labour, but 6*d.* a week is given in all my returns as the average cost per

bullock. To show how little energy is spent in this root slicing, a skilful man can cut up a root on the palm of his hand without hurting his skin.

The four course shift being the usual method of cultivation in the district, about one quarter of each farm is usually occupied in growing roots, and as the land is generally unfavourable for sheep, bullock grazing is a staple industry, and up to a few years ago was looked upon as highly remunerative, especially by those farmers who kept no regular accounts or made no yearly valuation of their business.

With a view to discovering the average actual profit that was made from bullock grazing locally, during the season of 1906 I distributed about 100 forms of some fourteen questions, asking graziers of my acquaintance to answer them. The idea of such an investigation was suggested to me by two statements which I had heard made about the same time.

The first was as follows: "The best season I ever had was when I had bullocks put in by a dealer to eat my roots." This was said by a man of means and practical experience, who, in order to save himself trouble and risk had recourse to the dealer. Having been previously imbued with the prevalent idea that a farmer who thus grazed other peoples' cattle was not making the profit he might otherwise have done, I was naturally somewhat surprised at my friend's statement. Later on I heard a well known grazier and dealer say to a third party that fifty bullocks which he had put in for a client left 10*l.* apiece after fattening, implying that this 500*l.* was clear profit. I then set myself the task of ascertaining, as nearly as possible, what was the actual average profit of winter grazing per beast, and the present paper contains the result of my inquiries.

METHOD OF CARRYING OUT THE INVESTIGATION.

In order that my investigation should give results as representative as possible, I asked for information from both small and large farmers, and sent inquiry forms to men whose reputation for producing good beef stood low as well as to those whose name stood high among the butchers.

The most important questions asked were as follows:—

How many bushels of roots do you give per bullock per day?

How many pounds of cake or meal and of what kind?

How many pounds of hay, chaff, or straw chaff?

What was your acreage of roots in 1906, and average weight of roots grown per acre?

What number of beasts did you graze per acre?

How long on an average did each of your bullocks take in fattening?

What were the average store and sale prices of your bullocks ?

NUMBER OF ANSWERS RECEIVED.

More than eighty forms were returned to me more or less fully filled in, and of these I selected forty of the most representative and reliable for tabulation and comparison. Many of the returns contained additional valuable and original remarks. Several gentlemen kindly submitted their cake bills and balance sheets for the year ; thirty-two stated the exact acreage of their root crop, and the exact number of bullocks grazed thereon.

THE USE AND VALUE OF ROOTS AND OTHER FOODS.

The local method of grazing seems to be fairly uniform, especially as regards the quantity of roots given per day. Experiments conducted in the county some years since (Whitlingham, Garrett Taylor, 1896-1898) indicate forcibly that a stinted supply of roots is false economy, although graziers in other parts of the country, less favourable to the production of roots than our own, accuse us of being prodigal in the use of them. I had, however, some difficulty in arriving at the actual amount of roots consumed per bullock per day, in consequence of the various sizes of "bushel" skeps locally in use ; some containing 45 lb., some 56 lb., and some 63 lb., of hand chopped roots ; and 40 lb., 52 lb., and 58 lb. respectively when the roots were pulped or shredded. From personal investigation I have taken three bushels of both swedes and mangolds chopped to average 135 lb.

Swedes and mangolds are each reckoned at 5*s.* per ton,[1] linseed cake is valued at 8*l.* a ton, cotton cake at 4*l.* 15*s.*, bean meal at 16*s.* 6*d.* for nineteen stone, or 6*l.* 19*s.* per ton, oat meal 11*s.* per twelve stone, or 7*l.* 6*s.* 8*d.* per ton, hay at 3*l.* per ton, and straw chaff at 30*s.* Other commodities are estimated at market prices or at the prices given me by the graziers. Sixpence a week is allowed for labour for each bullock, but no charge is made *for straw used for litter*, housing, interest on capital, insurance, commissions, or for veterinary or other incidental expenses.[2]

[1] In my original paper on this subject, read before the Stalham Farmers' Club, I allowed 7*s.* 6*d.* per ton ; this was generally objected to as being too high, and therefore, in deference to the expressed opinion of both graziers and valuers, I reduced it to 5*s.*

[2] Nor has credit been given to the feeding bullocks for the residual or manurial value from the food-stuffs used. In practice, the value of this asset has to be taken by the farmer in the corn or other farm produce that he sells. This will be referred to later on in the article. It is only when a farmer leaves his holding, and gets paid for his "valuation," or "tenant-right," that this item has a value which can be expressed in £ *s.* *d.*

RESULT OF TABULATING REPLIES.

I tabulated the forty selected returns in the following manner :—

1. In order of the number of weeks that the beasts were kept.
2. In order of the daily cost of food consumed.
3. In order of the price of stores.
4. A general summary showing the averages of all the items.

TABLE I.—*Table showing results obtained with beasts fed for the longest, the shortest, and the average periods.*

Price paid for stores	Number of weeks feeding	Gain per head at sale	Total cost of feeding	Net gain or loss per beast	Weight of roots given daily	Weight of artificial food given daily	Weight of hay and chaff given daily	Total cost of daily food +6*d*. per week for labour
£ *s.* *d.*		£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	lb.	lb.	lb.	*s.* *d.*
13 3 0	30 max.	8 17 0	8 1 3	0 15 9 gain	135	6	3	0 9
11 0 0	30 max.	7 10 0	9 4 9	1 14 9 loss	135	7	4	0 10¾
14 0 0	12 min.	7 0 0	6 8 3	0 11 9 gain	120	10	28	1 6¼
11 10 10	13 min.	7 0 0	4 5 5	2 14 7 gain	120	9	7	0 11¼
13 10 0	21 average	7 10 0	6 12 3	0 17 9 gain	135	8	4	0 10¾

As the tables from which I have deduced the results obtained are so very voluminous, it does not seem desirable to reproduce them here, and I therefore content myself with saying that it appears to me conclusive from Tables I. and II. that those who feed grazing bullocks most cheaply and those who keep them the shortest time have the most likelihood of some profit. This is irrespective of the prime cost of the stores. I was also struck by the fact that when long hay was given it proved, at 3*l.* per ton, to be an expensive item. Graziers like the reputation of producing a good bullock, but in doing so must trust to the manurial residue rather than to direct profit from the sale of the beast to recoup them for their outlay.

The more bullock yards I go into the more am I impressed by the fact that graziers generally hold their beasts too long, and the same lesson is taught by the returns made to me. Graziers seem usually to overlook the fact that every day a bullock lives he is consuming a certain amount of food merely to keep himself alive, and this daily ration is, except for the manure left behind, entirely wasted once the animal is fit for the butcher.

After sixteen weeks' keep a stone of beef will cost more, as a general rule, to lay on than it will realize. I had not a single return out of the eighty odd that were sent in to me where some profit was not made, provided the beasts were sold before having been shut up for seventeen weeks, irrespective of the price they cost as stores, and so long as the daily rations did not exceed 1*s.* 0¼*d.* in cost. Again, I have no return where the daily cost did not exceed 10¾*d.*, and the bullock was kept not more than twenty-nine weeks, which does not show some profit, a profit which, as I read the returns, would probably have been much greater than it was had the beast been sold earlier. It is certainly true that butchers prefer a bullock that shows his fat externally and handles well. Their preference is easily accounted for, because, as a general rule, the better a beast handles the better he will die, which is another way of saying the more internal fat he will carry. The consumers, the general public, do not require extra fat joints, so that we would emphasise that it is the butcher alone who gains; for much internal fat is not credited to the farmer when carcase weight is taken.

"Time and Turnips."

An ancient local adage states that "time and turnips," that is, plenty of both, are required for the production of prime beef, and it is said to be impossible by rapid artificial feeding, or without a prolonged diet of turnips, to secure a bullock which not only will handle and die well, but whose flesh will show a succulent marbling of fat granules surrounding the meat tissues of the cut up joints. This theory, however, when tested in practice by my investigations, has proved fallacious.

Some Comparisons.

Let us compare the results of keeping bullocks for the longest and the shortest times mentioned in the returns, namely, thirty weeks and twelve weeks respectively.

One lot of cattle fed for the longer period cost 12*l.* a head as stores, and were fed as follows: 156 lb. of roots, with hay and straw chaff only for the first fifteen weeks, then 4 lb. of linseed cake, 3 lb. of cotton cake, and 3 lb. of bean meal

for a further fifteen weeks, a total of thirty weeks' feeding in all. The average ration during this time cost $9\frac{1}{2}d.$ per day. The gain per head on sale was $9l.$, the net gain $13s.\ 9d.$ each.

Another lot of bullocks cost $14l.$ as stores. They were only grazed for twelve weeks, received a daily ration of 120 lb. of pulped roots, 7 lb. of linseed cake, 3 lb. of bean, oat, and maize meal mixed, and 8 lb. of hay and straw chaff. When sold they realised $7l.$ per head more than cost price, and left a net gain of $11s.\ 9d.$ each.

Here is a comparison of three sets of similar priced stores, kept for different periods of time upon various weights and mixtures of food :—

Prime cost	No. of weeks	Cost per day	Net gain or loss
£		*d.*	£ *s.* *d.*
11	30	$10\frac{3}{4}$	Loss 1 4 $3\frac{1}{2}$
11	20	$14\frac{1}{10}$	Loss 0 4 5
11	20	10	Gain 1 2 $0\frac{1}{2}$

It will be seen that from the above the first lot were kept too long, and that the second lot were supplied with too expensive food.

Comparing the first and third lots of bullocks together, which both cost the same price as stores, and both consumed practically the same amount of food and at almost the same daily cost, we find as follows: the third lot were sold at the end of twenty weeks and paid $22s.$ a head for their grazing, while the first lot were kept for thirty weeks and lost over $24s.$ apiece on sale. Both lots had plenty of turnips (about 130 lb. per diem), and those which were kept the longest were fed a little more highly on artificials. "Time and turnips" may be prime factors in producing prime beef, but in this instance proved remarkably unremunerative to the grazier in practical application.

Comparing again similar priced stores, we find—

Prime cost	No. of weeks kept	Cost per day	Net gain or loss
£		*d.*	£ *s.* *d.*
13	28	$15\frac{1}{2}$	Loss 0 16 $10\frac{1}{2}$
13	20	$15\frac{1}{4}$	Loss 0 8 9

This suggests that the first lot were kept too long and at too great a cost, while the second lot, though only grazed for twenty weeks, were too expensively fed.

In the following table we get the comparative cost of food of six lots of animals bought in at the same price :—

TABLE II.

Prime cost	No. of weeks kept	Cost per day	Net gain or loss
£		*d.*	£ *s.* *d.*
1. 14	24	$9\frac{1}{15}$	Gain 1 11 1
2. 14	24	$11\frac{3}{4}$	Loss 0 17 7
3. 14	22	14	Loss 2 10 9
4. 14	20	$10\frac{1}{7}$	Gain 0 17 9
5. 14	18	$13\frac{1}{2}$	Loss 1 3 0
6. 14	12	$18\frac{1}{4}$	Gain 0 11 9

It will be seen that the first and second lots of beasts differ very much as regards profits made. We find, in the case of No. 2, that their food cost 1*l.* 17*s.* 7*d.* more than that of No. 1, which goes far towards explaining this. The food supply of the third lot was evidently far too dear, whilst the cheapness of the rations supplied to the fourth lot allowed of a margin of profit. Lot No. 5 were too expensively fed, while the short time that No. 6 were kept enabled them, though costing so much more per head per day, to show a balance on the right side.

BEST AND WORST RETURNS.

The *best* return made to me showed an average sale gain per beast of 3*l.* 19*s.* 4*d.* The average price of the stores was 12*l.* They were kept for twenty-two weeks, receiving meanwhile per day 135 lb. of roots, 4 lb. of linseed cake, and 7 lb. of hay and chaff, at a total cost of 6*l.* 0*s.* 8*d.* per head. They averaged 22*l.* apiece on sale.

The *worst* return sent in was as follows: Cost of stores, 14*l.* each. They were kept for twenty-two weeks at an average cost of 9*l.* 10*s.* 9*d.*, their food consisting of 135 lb. of roots, 5 lb. of linseed cake, 4 lb. cotton cake, 3 lb. bean meal, and 7 lb. of hay and chaff daily; the result being a loss of 2*l.* 10*s.* 9*d.* per bullock. Comparing these two returns, we find that the two lots of bullocks were kept for the same time and received the same quantity of roots; one lot, however, had twice as much artificial food as the other, and yet finished off 6*l.* 10*s.* 2*d.* per head the worse. This result suggests that either the 12*l.* stores were most advantageously bought and sold, and were of better quality to start with, or that the 14*l.* beasts were both over-kept and over-fed. There may have been some mistake in the figures given me, but I am certain that those who filled up these two forms both believed that the figures which they laid before me actually represented what their bullocks had respectively cost them.

OUTLAY.

The greatest average outlay in fattening was 11*l.* 16*s.* 10*d.*, and the least in all the returns was 4*l.* 5*s.* 5*d.* The former lot of bullocks cost 13*l.* to buy in and gained 11*l.* per head on sale, after having been kept for twenty-eight weeks, a loss of 16*s.* 10*d.* per beast. Those that cost least to fatten had cost 11*l.* 10*s.* 10*d.* each to buy in, and gained 7*l.* per head on sale after having been grazed for thirteen weeks at a cost of 11¼*d.* per day, or 4*l.* 5*s.* 5*d.* for the whole period. They thus showed a net gain of 2*l.* 14*s.* 7*d.* The daily rations of the former lot were 168 lb. of roots, 2 lb. of linseed cake, 2 lb. of cotton cake, ¼ peck of barley meal, the same of bean meal, and 4 lb. of hay; whilst the latter had 120 lb. of pulped roots, 6 lb. of cake, 3 lb. of bean meal, and 7 lb. of chaff.

Comparing those bullocks on my list, whose daily food cost the most with those whose food cost the least, I find that stores at 14*l.* each that were kept for twelve weeks at a cost of 18¼*d.* a day sold for 7*l.* gain, or a net profit of 11*s.* 9*d.* per head. The detail of their feeding has been previously given, see No. 6, Table II., page 88.

Stores bought at 13*l.* 15*s.* and kept for twenty-six weeks at 6¾*d.* per day gained 7*l.* 8*s.* apiece on sale, and left a satisfactory balance of 2*l.* 3*s.* 2*d.* each. They had during the above period been given a daily ration of 3 lb. of straw chaff, 3 lb. of long hay, 3 lb. of cotton and linseed cake mixed, and 120 lb. of pulped roots, totalling 129 lb. I may say that this lot of bullocks, contrary to general practice, were given mangold and swedes mixed from the first.

Many feeders, in computing their profit on grazing, merely compare the price at which they buy in, with that at which they dispose of their bullocks, not taking any account of the time they stood out of their money, or of the cost of keeping the beasts. There is, however, evidence of the fact that long ago winter grazing was known to be an uncertain business, witness the saying that "three good root crops in succession will ruin any farmer." The meaning of this proverb is that a plethora of roots causes an unusual demand for stores, and so runs up their price. It follows from the extra large numbers of stores put up, that fat cattle are over produced with a consequent fall in the selling price of beef.

According to the forty selected returns, the average net gain per beast for winter grazing works out at a fraction under half-a-guinea, but taking only those thirty-two forms which I selected as being the more especially reliable, this profit is reduced to a fraction over 8*s.* 8*d.* Whilst gathering information by conversation for the purpose of this investigation, I found that graziers generally scorned the idea of the net profit

per beast being under 2*l*. Supposing the prime cost of the store, together with the expense of fattening it, came to 20*l*., and the time taken in grazing it were twenty-six weeks, and the profit arising therefrom 2*l*. this would be at the rate of 20 per cent. interest per annum; whereas, according to the figures given me for the purpose of this inquiry, the outlay on bullock grazing does not yield 6 per cent. on the average.

Number of Beasts Grazed per Acre of Roots.

I think it will be of interest to give the following statement showing the maximum, minimum, and average weights and values as arrived at by a summary of the thirty-two selected returns.

No. of beasts grazed per acre	Estimated weight of roots per acre	Value of roots per acre at 5s. per ton	Actual net gain or loss per beast
		£ *s.* *d.*	
Maximum 3	40 tons	10 0 0	Maximum £3 19 4 (gain)
Minimum 1	18 tons	4 10 0	Minimum £2 10 9 (loss)
Average 1·8	25 tons	6 5 0	Average £0 8 8 (gain)

Stores.

A comparison of the data concerning the highest and the lowest priced stores, bears out the generally received idea that the smallest cattle take the longest time to prepare for the butcher, 8*l*. stores being held for twenty-eight weeks, whilst those which cost 16*l*. apiece went to market at the end of eighteen weeks.

Some of our most successful graziers endeavour to secure the best possible stores, *i.e.*, the largest and most forward in condition, believing, according to their own saying, that "meat can be bought cheaper than it can be made." The grazier, moreover, can always find a ready sale for such bullocks as he cannot finish off for want of sufficient roots, it being a prevalent idea that the first half time of a beast's fattening is the most expensive, and that it is only during the latter period of grazing that a bullock begins to grow into money. It may appear so, if the eye alone be taken as a guide, but all carefully conducted experiments have proved that the last stones cost most to lay on. The success of those graziers who believe otherwise probably depends, not upon the more forward condition of the stores they buy, but upon their own practical judgment and skill in the selection of animals that are naturally

good doers and that will grow, as well as fat, whilst grazing, and further, on subsequent judicious management.

Three complaints are frequently heard about the present supply of stores. In the first place there is their high price; secondly, that the Government veto prevents the importation of Canadian lean cattle, which is generally supposed to be the cause of the former complaint; thirdly, local graziers say that they can only get the "culls," the best of the animals, bred either in Ireland or in our grassland counties, being either sold and killed straight from pasture or otherwise disposed of elsewhere. Those that arrive at Norwich Hill are, they say, mixed up, originating from various localities and strangers to one another, and they consequently take some time before settling down. The practice of dishorning full grown bullocks is no longer carried on, but the presence of a bull in a yard of turbulent horned bullocks is held to ensure order and quietude.

There seems to be a general consensus of opinion in favour of single boxes over open yards or closed sheds in which a number of beasts are tied up. Those grazed in the latter fashion are said not to develop their forequarters proportionately.

The use of rock salt is not at all general, and I have neither seen nor heard of a lump of chalk being supplied to small beasts as used to be the almost regular practice with Essex calf-rearers.

In spite of the precautions taken against cruelty on Norwich Hill, I believe that many pounds are lost to graziers by the nose and hide soreness of animals that have been unnecessarily knocked about at market.

Very few home breds are locally reared. The purchase and upbringing of calves has been experimented with, but pastures hereabouts are few and flies are plentiful, and moreover, our comparatively short annual rainfall does not encourage the continual growth of grass. Some few heifers and calves are fatted together, but not so many as formerly, although a handsome return generally results as compared with the average profit arising from steers, whilst on the other hand there are, of course, some extra risks incurred.

It is interesting to remember that in Kent's *Norfolk Tour*, published in 1808, an acre of roots is said to have produced from thirty to forty three-horse cartloads, which would fat a 40 or 50 stone Scotch bullock. We do more than this now.

In Marshall's *Rural Economy* of the county, 1787, we find that the present preference of our chief graziers for large and forward stores was even then the vogue. He says: "Mr. R. always buys a good bullock. If a man don't buy a good thing, he can never expect to have anything capital; he does not mind a few shillings at St. Faith's" (fair held in October).

"We think nothing of a difference at this time of the year of 3*l.* or 4*l.* a bullock"; and again, "Mr. B. always buys the best bullocks he can lay his hands on, and he is, and has been for some years, esteemed very justly the best grazier in this neighbourhood."

From the same authority we find that the greater weight and feeding value of smaller roots closely grown was thus early realised, though some farmers are even now sceptical on these points. Mr. Marshall quotes two authorities who were always attentive to their hoers, to see that they did not set out the plants too thin, attributing "the good proof of turnips, chiefly to their thightness" (*i.e.*, closeness on the land).

As to the comparative value then of Irish and home bred stores, nine of the former, bought at St. Faith's fair (October 17), seven at seven guineas each, and two at six guineas apiece, were again sold at Smithfield in the beginning of June, four of the smallest at 16*l.*, and the remainder at 18*l.* and upwards. "This," Mr. Marshall adds, "is probably the greatest grazing that ever occurred in the county. Much, however, depends on the choice of a bullock for fatting. The Norfolk farmers know, or pretend to know, whether a bullock will grow during the time of his fatting; and it is the bullock which grows and fats at the same time which leaves most profit to the grazier."

The specially good return made by home breds is reported as follows: "Nine beasts sold, one for 10*l.*, the rest for about 9*l.* apiece, so that in less than seven months they more than doubled their cost, paying about 3*s.* 2½*d.* a week, which, notwithstanding their high price as stores, is great work for a bullock of less than 40 stone, and shews in a striking manner the value of the Norfolk breed of cattle."

As to the indescribable something which makes the good judge, Mr. Marshall rightly adds, "a thick skin is a favourite point in Highland cattle: and there may be other points symptomatic of a growing bullock, but I am apprehensive that a good grazier forms his judgment from general appearances, and from intuitive impressions, rather than from particular marks and signs: and I am of opinion, nothing but continued practice and close attention can make a man a judicious grazier."

The Middle Man.

The margin of profit on winter grazing being so small and uncertain, and the roots grown for this purpose being the most expensive crop to produce in the four-course shift, all possible care must be taken to keep down as much as possible all incidental expenses connected with the sale and purchase of the bullocks. The usual commission, if a middleman be employed either to buy in or sell out, varies from five to ten

shillings a beast. The profit arising from fatting that beast may thus easily be absorbed, but so much depends on the quality of the stores procured that it is better to pay for the services of a capable man than to rely upon one's own judgment, if that be faulty and uncertain. I have previously referred to the custom of "putting in" bullocks, and this method is generally adopted by those who are short of cash or credit, and several good judges of bullocks, with plenty of capital at their command, make a lucrative business out of sending (or "putting") in cattle to consume their neighbour's roots, at so much a head or so much a week.

Printed forms containing the conditions as between dealer and grazier are in vogue, and are signed by both parties to the contract. A large proportion of graziers hereabouts fat bullocks on such terms at about 3*s.* per week. Perhaps half of our graziers buy their own stores, while the other half pay some one else a commission to purchase for them, or else have beasts put in to consume what roots they grow. More of this latter procedure goes on than is generally supposed, the tendency being for tenant farmers to rent more land than they have capital for, knowing that they can always be accommodated in this manner. Most of the small farmers commence business in this way.

MARKETS.

Norwich Castle Hill is the centre of the great beef industry of the Eastern Counties, and is the largest market for store cattle in England, beasts being brought here from all parts of the United Kingdom. According to the official returns, last year (1908) was a record season, no less than 95,439 store cattle passing through the market. 32,632 fat bullocks changed hands, but this was 464 less than in 1907. The market toll for the latter, as well as for the bulls, is 3*d.* per head, and for stores and cows 2*d.* The total fees received at the cattle market were put down as 2,065*l.* last year, showing a profit to the Corporation of about 1,000*l.* The market opens from November to February inclusive at 8 a.m., and closes at 4 p.m., and during the remaining months the hours are from 6 a.m. to 5 p.m. Formerly the cattle market was held on Tombland, but there seems no record of when it was moved thence to the Castle Hill. In early times beasts for sale were probably kept on the Town Close. The earliest charter was granted by Edward IV. in the first year of his reign, and is dated February 12, 1461.

It is greatly to be desired that drovers should be licensed, as this would be of much assistance in further curtailing the unnecessary cruelty to the cattle, though there has been a very noticeable improvement in this respect since the R.S.P.C.A.

has placed inspectors on the Hill; but still, in spite of all precautions, drovers and loafers are constantly to be seen prodding and whacking any inferior animal that ventures to show itself conspicuously under their, often self-constituted, charge. Many pounds are lost annually to graziers in consequence of the ill-treatment of stores at market, from which sore noses and eyes and bruised bodies result.

The largest dealer in store cattle on Norwich Hill has been known to dispose of no less than 4,500 beasts in a month, and once, I believe, he sold 1,400 on one Saturday.

The earliest buyers in the day are generally the most successful. In the first place they get the pick of the market, and, secondly, the cattle then bought do not have to stand the racket of a whole day on the Hill, from which some beasts do not entirely recover for at least a month.

The bulk of the stores offered at Norwich comes from Ireland, the Midlands, and the North of England. Home breds—Shorthorns and Lincolns—find most favour with graziers, and Herefords are perhaps least in demand. Aberdeen Angus are seldom plentiful. Some of our graziers go to Leicester for stores, and a few to Shrewsbury, but fewer in each case than was the custom a few years ago. Most even now prefer Norwich.

Some stores have, now and then, been sold there by weight. One of my correspondents tells me of a lot thus bought there at a less price than had previously been bid for them as they stood. Other graziers, on the other hand, have had to pay more dearly than they anticipated when making their bargain, in consequence of leaving the machine to decide the price they were to pay per beast.

Disposal of Fat Beasts.

The tendency to sell at home seems to be on the increase. Probably about one-third of all the bullocks fatted in the district are disposed of in this manner, while the rest are sent to the local markets, Norwich chiefly, nearly every other locality in England being represented here by dealers who buy to send to their own markets. Other bullocks are sent to London and Leicester, the latter bearing a good reputation locally for prices.

The old-fashioned plan of sending fat cattle to London in charge of a local salesman seems to be rapidly dying out, and I am only aware of one man now being thus employed.

There is a weekly market during the season at Yarmouth and North Walsham. The only remaining fairs of any account in the district are "Tombland" Fair at Norwich, held on the Thursday before Good Friday—this is chiefly a market for

stores for marsh grazing—and Ingham Fair, held on Trinity Monday. This market is said to date back to 1360 A.D., when one, J. Rump, started a repository sale here. Instead of decreasing in popularity as most rural fairs have done within recent years, Ingham seems to be increasing in favour as a mart for fat cattle.

Buyers attend from all parts of the country—Yorkshire, Derby, Manchester, Birmingham, Leicester, Nottingham, Bedfordshire, Portsmouth, Southampton, and London all being represented. Trade is generally good, as beasts of the best quality only are usually on offer.

The East Norfolk Stock Mart Company, in which several graziers in the district are interested, offer prizes for cattle submitted to them at Ingham Fair.

It is interesting to note that in the *History of Agricultural Prices in England*, Professor Thorold Rogers states that in 1249 the price of a horse at Ingham was 5*s.* 6*d.*, that of an ox, 8*s.* In 1270, 8*s.* 6*d.* was given for a bull. In 1259, wheat sold at Ingham for 5*s.* 6*d.* a quarter.

The Weighbridge.

The weighbridge is a valuable help both to buyer and seller, as well as of great assistance to the feeder in giving him a definite idea of the progress that his beasts are making. It cannot, of course, replace experience and good judgment, but it is a very useful adjunct to them.

The present disregard of this instrument is inexplicable, but it is partly, no doubt, due to the extent to which dealers trust their own powers. The block test competitions all over the country have shown how near some can estimate. But they have also shown, on the other hand, how many farmers are quite unable to do this. As showing the present contempt for the machine's assistance, I may say that quite recently at Norwich, I heard a local grazier say, speaking of the weighbridge, "Nobody ever looks at it," and yet another farmer observed, "You are no good on Norwich Hill unless you can judge the weight of a bullock within a stone."

I have only come across one instance in which the weighbridge has been used locally in order to ascertain the weight gained during the earlier and later periods of feeding respectively. This instance confirms the scientific opinion that the first few weeks of fattening are the most economical, and is opposed to the opinion of the great majority of graziers who look chiefly to the last two months for their profit.

The above-mentioned experiment was a regular revelation to the owner of the beasts, as previous to this test he had been much disappointed at the apparent want of progress made by

the cattle during the first period of grazing. He had not supposed that they had gained any weight, whereas the weighbridge showed him that they had increased over 3 lb. a day for nineteen days. Herein, I think, is the explanation of how graziers are frequently misled into thinking that their profit is made during the latter period of fattening, the fact being that the progress then made is more visible, though also more expensive and slower than that made during the earlier period.

The weighbridge is an undoubted safeguard to a man who is but a poor judge of the standing value of stores or of fat cattle, and also to the good judge of live weight when buying on commission. It is therefore regrettable that its use on Norwich Hill and elsewhere is so restricted.

General Summary.

A summary consideration of all the returns submitted to me leads me to say :—

1. That local graziers are not making nearly so large a profit from the production of beef as they themselves have hitherto thought.

2. That the longer the beast is kept after sixteen weeks, the more uncertain the profit becomes.

3. That the highest feeders are not the greatest gainers.

4. That the net profit being so comparatively small and uncertain, great care and skill are required in the selection of stores, in getting them on to fattening foods as rapidly as possible, and in the curtailing of all incidental expenses.

5. The necessity of knowing when the cost of keep, together with the prime cost of the store, approximates to the selling value of the fattened bullock.

The great value of these returns, is of course, in the fact that they represent, according to the graziers' own statements and figures, what is being done by local men whose prime object is to make a direct profit from the production of beef, manure being with them a secondary consideration. I may say that, after having tabulated the returns, I read a paper based upon them before our local Farmers' Club. Many of those who had supplied me with particulars were present, but though surprised at my conclusions they could not controvert them, though more than one gentleman remarked that if they were correct he must have been ruined long ago. The explanation of such not having happened, in my opinion, is in the fact that in spite of the recent low price of wheat, enough money has been made out of corn growing to compensate for the poor return from grazing bullocks.

Some, who recognised that there was not so much profit in the practice as had hitherto been supposed, gave as an excuse

the perfectly true statement that they could not farm without manure, and that they must have bullocks to tread down their straw. To them my answer was, "Quite right, but see that you do not keep them too long."

I was then met with the objection, "We cannot send our bullocks to market when they are what the butchers would call 'about three parts fat,' because we cannot replace them with similar stores. Small stores won't pay, or won't do on my farm, and I must consume my roots and convert my straw into manure, and so I spin out the time for grazing my bullocks accordingly." There may, in some seasons especially, be some truth in the statement that it is not possible to produce suitable stores after Christmas, but supply is generally ruled by demand. It is the fashion now for all our local graziers to buy the bulk of the bullocks they require at the same place and about the same time, meeting together on Norwich Hill and bidding practically one against the other. The dealers know this, and prices are thus inflated. Surely co-operation is needed here.

The average price paid by forty graziers for their stores, totalling altogether 4,060 bullocks, was 13*l.* 1*s.* 2*d.*, giving a total of 52,983*l.* Taking now the averages concerning these beasts, we find that they were kept for $21\frac{3}{10}$ weeks at a cost of 7*l.* 1*s.* 2*d.* per head, for which they each were supplied throughout the whole time with $7\frac{3}{4}$ lb. of artificial food daily, together with 133 lb. of roots, 6 lb. of long hay, hay chaff, or cut straw, and sold for an average sale gain of 7*l.* 11*s.* 7*d.* apiece, or a net gain of 10*s.* 5*d.* each. The total average daily consumption of food was thus $147\frac{1}{2}$ lb., and their daily maintenance amounted to $11\frac{1}{2}$*d.*, which includes 6*d.* per week per

TABLE III.—*General Summary of Forty Tabulated Returns.*

Cost of stores	No. of weeks fattening	Gain per head on sale	Total cost of fattening	Net gain or loss per beast	Weight of roots given per day	Weight of artificial food given per day	Weight of chaff given per day	Total cost per day +6*d.* per week for labour
1	2	3	4	5	6	7	8	9
Maximum[1] £ *s.* *d.*		£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	lb.	lb.	lb.	*d.*
16 0 0	30	11 0 0	11 16 0	3 19 4 (gain)	189	14	28	$18\frac{1}{4}$
Minimum[1] 8 0 0	12	5 5 0	5 4 9	2 10 9 (loss)	90	3	3	$6\frac{3}{4}$
Average 13 1 2	$21\frac{1}{3}$	7 11 8	7 1 2	0 10 6 (gain)	133	$7\frac{3}{4}$	6	$11\frac{1}{2}$

[1] *N.B.*—The figures in each line do not refer to the same animals throughout.
NOTE.—Food weights in all tables represent *average* daily consumption during the whole period of grazing.

bullock for tending. The evidence of all the returns made to me—that is over eighty—proves that directly the daily cost of grazing exceeds $10\frac{3}{4}d.$, or the beast is kept for more than sixteen weeks, the question of profit becomes very uncertain. A rapid turnover in capital is a point to be observed in every business, but it seems, according to these returns, to be greatly neglected by local graziers.

To show the extent of the business referred to in the forty tabulated returns, I may say that they include particulars relating to the grazing of some 4,060 bullocks, which cost 52,983*l.* to buy in, and over 28,623*l.* to fatten. They meantime consumed more than 35,000 tons of mangold and swedes, which, at 5*s.* per ton, may be reckoned at nearly 9,000*l.* They also consumed some 2,058 tons of artificial food, which, at 6*l.* 10*s.* per ton on the average, would have cost 13,375*l.* 1,547 tons of hay, cut hay, and straw chaff, being used as food, this, at 2*l.* only per ton, comes to over 3,090*l.*, and labour would cause the local expenditure of another 2,130*l.* It will be seen from these figures that the expenditure on artificial food exceeds the value of the roots consumed.

There is, as I have said above, a general consensus of opinion as to the advantages of separate boxes over tying up, or over open yards. Each beast in a loose box gets its fair and uninterrupted share of food, and it is easier for the attendant to see when a bullock is at all ailing or is off its feed. Bullocks undoubtedly "get their coats" quicker under cover, and the same quantity of food goes further than when fed to them in an open yard surrounded by shelters, there not being so much food wasted in keeping up internal heat. At the same time proper ventilation is necessary in enclosed premises to prevent sweating. I have seen bullocks that had clipping irons run down once on either side of the spine to obviate this.

As this paper will probably reach some of those who, at so much trouble to themselves, have kindly assisted me with information, without which I should have been unable to compile it, I wish in conclusion to express to them my grateful thanks.

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WHEAT PRICES AND THE WORLD'S PRODUCTION.

THE trend of wheat prices in Great Britain last year, when the *London Gazette* recorded averages of 48*s.* to 50*s.* per quarter in many markets of the country, has once again drawn public attention to the question of our wheat supply. The problem of feeding the population of this country, and of Europe generally, has for many years lain dormant under the soothing influence of low prices. But the sharp upward movement which occurred last spring has re-awakened the interest and anxiety of the public. It has also attracted the attention of the British agriculturist, but in a somewhat different way. The prices which he has been getting during the last two years have been far more profitable than for some time past, and he has been asking himself whether wheat is once more to resume its position as the dominant agricultural product of the country, or whether the brief glimmer of prosperity will not presently be extinguished in a lasting gloom of depression.

Both the consumers of bread and the producers of wheat are uncertain as to the conclusions to be drawn from last year's experience, for outside trade circles people are inclined to believe that the rise in price was due to the market manipulation of speculators, and not to a real change in the conditions of the world's supply. Whether the rise is due to natural causes, or whether it is only an artificial disturbance in the steady flow of prices, is a matter of fundamental importance to both the buyer and the producer. It is the object of the present review to throw such light on this question as is afforded by a study of the present position of the world's market, and of the steps by which modern conditions have been reached.

At the present day more than four-fifths of all the bread consumed in this country is made of corn imported from foreign lands, less than one-fifth being produced at home. The British farmer is thus in a position in which the market for one of his chief products is determined by foreign conditions. Such a state of things would have been unbelievable a hundred years ago. Even so late as 1847 Porter wrote in "The Progress of the Nation" as follows :—

"To supply the United Kingdom with the single article of wheat would call for the employment of more than twice the amount of shipping which now annually enters our ports, if, indeed, it would be possible to procure the grain in sufficient quantity."

Yet, sixty years later, not only do we import a vastly greater quantity of wheat than would have sufficed for the whole

population of that time, but it is purchased at a fraction of the price. Moreover, reliance on other countries for our food, so far from causing anxiety to the consumer, has diminished the likelihood of famine by diversifying the sources of supply. The consumer of wheat is no longer dependent on the vagaries of the British climate, but is, practically—leaving out the risk of war, &c.—assured of a steady and certain supply, year in and year out.

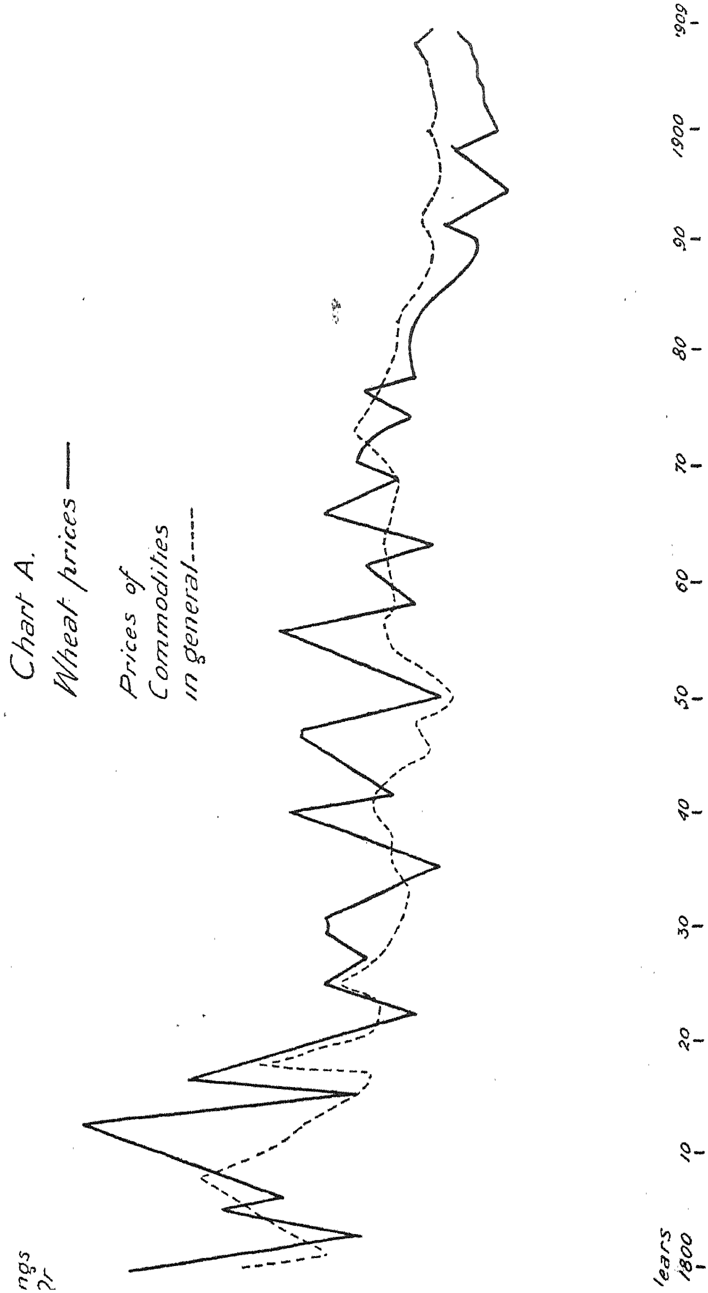
The influence of changing conditions is best seen by tracing in outline the history of prices. Two broad tendencies are evident at once from the most casual glance at the figures. In the first place there has been a continuous fall in prices, and in the second an increasing steadiness and absence of big fluctuations. These two tendencies are shown by the following table, which represents (i.) average prices per quarter of wheat in England and Wales for periods of 10 years, (ii.) the highest and lowest annual averages during the same periods, and (iii.) the margin between the highest and lowest annual average prices.[1]

	A Average	B Highest price	C Lowest price	D Difference between B and C
	s. d.	*s. d.*	*s. d.*	*s. d.*
1800-1809. . .	84 8	119 6	58 10	60 8
1810-1819. . .	91 5	126 6	65 7	60 11
1820-1829. . .	59 10	68 6	44 7	23 11
1830-1839. . .	56 9	70 8	46 2	24 6
1840-1849. . .	55 11	69 9	44 3	25 6
1850-1859. . .	53 4	74 8	38 6	26 2
1860-1869. . .	51 8	64 5	40 2	24 3
1870-1879. . .	51 4	58 8	43 10	14 10
1880-1889. . .	37 0	45 4	29 9	15 7
1890-1899. . .	28 9	37 0	22 10	14 2
1900-1909. . .	29 5	36 10	26 9	10 1

In the first column the price of wheat is seen descending, at first rapidly, then more slowly until the decade 1870-9. After that it quickly falls again; ending up with a rise in the last period. The second and third columns, showing the highest and lowest annual average prices, move in a similar way, and the last column shows how prices have become more steady during the century.

If we construct a chart in which the horizontal distances represent the successive years, and the vertical ones the price of wheat, we get a curved line which represents very graphically the fluctuations of prices. At the beginning of the

[1] In compiling the following table, and in collecting the data on which this article is based, I have received valuable assistance from Mr. C. K. Hobson, of Trinity College, Cambridge, who has made a special study of this subject.



NOTE.—In the dotted curve prices in 1871 are taken as basis and equivalent to 50s. in the Wheat prices curve.

century we find enormous variations: 112*s*. in 1800, 57*s*. in 1803, 123*s*. in 1812, 44*s*. in 1822 (see Chart A). Then for fifty years the prices fluctuate up and down between 40*s*. and 75*s*., with an average of about 55*s*., while in the last thirty years of the last century they drop with fluctuations to about 25*s*.

If again we plot on the same chart a curve showing the variation in prices of commodities in general, we shall find that the two correspond on the average until about the year 1850. This means that, although the wheat producer was getting less cash for his product, that the value of his money in other goods was increased. He was, in fact, really not worse off on account of the fall in prices.

From about 1850 until 1873 the curve of general prices rises, while that of wheat prices continued to fall, so that measured in terms of other commodities, the real value of wheat fell more than the money price. In 1873 general prices again began to fall until the year 1896, but again the money price of wheat fell more quickly. Wheat was therefore still becoming cheaper for the consumer, while the producer was, of course, getting a diminished quantity of goods for his wheat.

Suddenly in the middle of the last decade of the century both curves began to rise. Evidently some influence had come into play changing the money value of commodities in an upward direction, and looking at the respective dates, it is impossible to avoid the conclusion that to some extent at all events, the rise was due to the enormous increase of the world's production of gold, especially in South Africa.

We have no space to attempt the colossal task of accounting fully for the movements of prices which we have outlined above, but the main stages in the development of wheat production both at home and abroad must be known if we are to appreciate the present position of the world's wheat problem.

The century includes four periods each with characteristic features of its own.

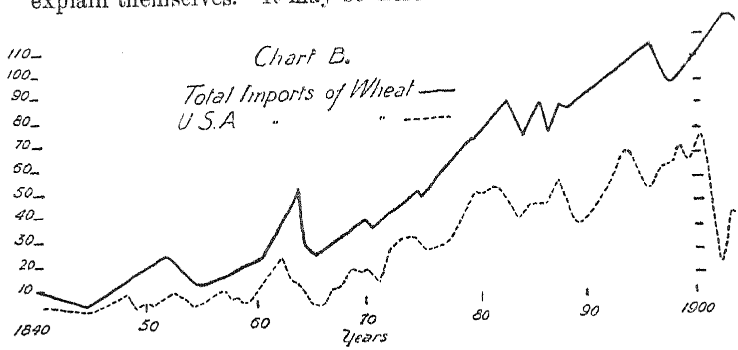
First period.—For nearly the first half of the nineteenth century, Great Britain depended almost entirely on native grown supplies of wheat. We had practically ceased to be an exporting country before the end of the previous century, and the tendency was now the other way. The thirty years 1815-45 were years of high protection for the British farmer, and in consequence the corn growing area embraced all land that could be so utilised, while the methods of production were much improved. This is evident from the fact that, though the population trebled between the middle of the eighteenth and the middle of the nineteenth century, England was almost able to grow sufficient food at home. This fact testifies to the greatly increased productivity of agriculture, which was,

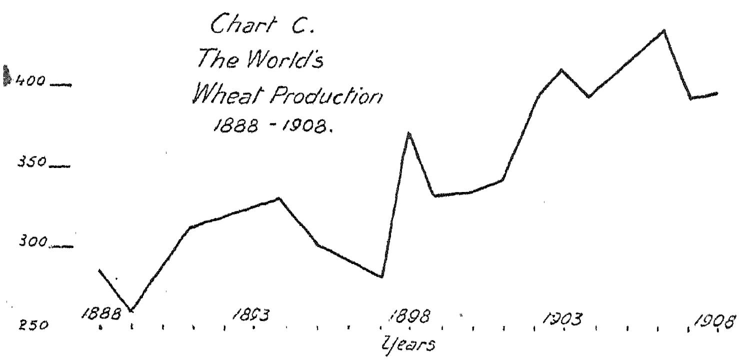
nevertheless, at last outrun by the growth of population. In years when the yield of the harvest fell off, the working classes suffered terribly from high prices and the pressure culminated at last in the Anti-Corn-Law Agitation of the Hungry Forties.

Second period.—The abolition of the Corn Laws in 1846 constitutes the beginning of a new epoch, and from that time our consumption of foreign wheat rapidly increased. In 1852-56 we imported a yearly average of 4,560,000 qr.; by 1868-72 the average had risen to 8,741,000 qr. These supplies, during the first twenty years of this period, were obtained almost wholly from European countries. Russia sent the largest amount, and the effect of her supply on prices during the time was remarkably evident when the Crimean War put a stop to our commercial intercourse with her. Prices rose rapidly, and the year 1854 was one of considerable distress to the workers of this country.

Third period.—From about 1870 we may date the beginning of a new era, the main feature of which was the domination of the American market which, owing to the increasing facilities of transport in the United States, could now draw supplies from a large area. Labour indeed was exceedingly scarce, and land was cultivated in a very superficial way. In an empty continent, however, the value of land is small, and the American farmers were able to produce crops at an exceedingly low cost, as, although the yield per acre was small, the rent was almost a negligible item. About the year 1870, owing to these conditions, our markets began to be flooded with wheat, and prices were driven down, causing severe depression in British agriculture, and in the farming districts of nearly all European countries. From that time the quantity of wheat sent to us from the United States continued to grow until the end of the century, the proportion of our supplies from that source increasing from 24 per cent. in 1856-60 to 40 per cent. in 1871-75, and 60 per cent. in 1896-1900. The magnitude of this growth will be obvious if the imports from the United States are expressed in absolute quantities. In 1856-60 we yearly consumed about 1,320,000 qr. of American wheat, in 1871-75 4,680,000 qr., and in 1896-1900 about 13,360,000 qr. The stress of competition which these figures indicate has had a great effect in stimulating new methods in European agricultural practice. But our friend the enemy had as many perhaps more of the advantages which science, engineering skill and up-to-date commercial methods could give to the farmer, and in spite of every effort, farmers in this country were, to a great extent, forced to turn their attention to other crops. Between the years 1871-75 and 1902, a period which included the terrible season 1879 and those unsatisfactory

harvests which followed, the acreage under wheat in the United Kingdom fell by nearly 2,000,000 acres, from 3,737,000 to 1,773,000. The enormous increase in imported supplies and the part played by the opening up of the United States is indicated on the diagram (Chart B), the details of which explain themselves. It may be here mentioned that the self-





binder, in general use in the United States of America for several years before being introduced into this country, was an enormous help to the transatlantic wheat grower.

Meanwhile, home production actually fell off, thus forming a rapidly diminishing proportion of the whole. It is difficult to give precise[1] figures on this point, but such as we possess indicate that the home supply fell from 60 per cent. in 1860 and 50 per cent. in 1870, to 15 per cent. in the last five or six years.

[1] The amount of the British crop which is sold in our public markets for consumption is only a matter of conjecture. But we shall not be far wrong in assuming that $\frac{1}{5}$ of the crop is consumed by stock, is wasted, or is used as seed corn. This assumption enables us to get some idea of the proportion of our food supply provided by our own farmers.

Fourth period.—The last period of rising prices coincides with the falling off of supplies from the United States of America and the opening up of other sources of supply. By the beginning of the last decade of the century, the United States was becoming much more densely populated, and her growing town population consumed very large quantities of her own cereal products. A demand for wheat had begun to appear in Germany, where the growth of an industrial population and a rise of the standard of living both helped to make her home production insufficient for her needs.

On the other hand the filling up of America caused a rise in rent and an increase in the cost of production. The use of land for building and for such agricultural purposes as cattle farming, beet-root growing, &c., began to drive wheat farming further west, or else caused it to be carried on under more expensive conditions. Wheat production thus for the moment received a check, and even began to decline.

Thus we find a diminution of the world's crop at a time when the number of wheat consumers was growing by leaps and bounds. In 1871, according to Sir William Crookes, the bread eaters of the world numbered 371,000,000. In 1881 they had grown to 416,000,000. They increased to 473,000,000 in 1891, and 516,000,000 in 1898.

Up to the nineties the world's crop increased as rapidly as the demand, but from 1894 the supply began to fall short. The following table, which is illustrated by Chart C, gives the world's wheat crop in millions of quarters in each year from 1888 onwards. The figures show the maximum point reached in 1894, and the subsequent decline in the next few years.

	Million quarters		Million quarters
1888	283	1899	328
1889	273	1900	332
1890	288	1901	347
1891	309	1902	396
1892	314	1903	407
1893	319	1904	395
1894	327	1905	416
1895	305	1906	429
1896	298	1907	393
1897	286	1908	397
1898	366	1909	

The check to production and the increase of demand was noticed by Sir William Crookes, who in an address to the British Association in 1898, raised the alarm of a world's wheat famine. But the situation had also struck a young operator on the Chicago Board of Trade. Seeing the inadequacy of the world's supply, Mr. Leiter took the opportunity to make his famous corner in American spring wheat. The clique of bulls

who were operating on his behalf began to buy at $64\frac{3}{4}$ cents on June 18, 1897, and from that time prices began steadily to rise. But while his holdings of actual wheat were very large, amounting at one time to 35,000,000 bushels, he bought far greater quantities of "futures" from speculators who contracted to deliver the grain at the end of May. By so doing they delivered themselves into his hand, for in May Leiter held the only wheat on market, and he was able to squeeze his debtors of every dollar they possessed. On May 10, 1898, wheat stood at the enormous level of 185 cents a bushel—a rise in one year of nearly 200 per cent. So great was the desire to take advantage of the conditions, that wheat which had already gone forward to Duluth to be milled was actually returned to Chicago to be delivered to Mr. Leiter. But intoxicated with success, Leiter attempted to carry over his deal into June. Early in that month, however, it was evident that abundant supplies were coming forward, and instead of finding the dealers who had pledged themselves to deliver him wheat unable to do so, Mr. Leiter had wheat thrust upon him from all quarters.

It will have been observed from the preceding table that the world's wheat crop in 1898 was the largest ever grown up to that time, large contributions coming in not only from America, but from all countries. Some may think this a splendid example of poetic justice. More prosaic persons will be satisfied to find an explanation in the price of wheat, which had been steadily rising for the last five years. The Leiter corner is in fact the best example in history of the response of production to a rise in price. In the early part of the year 1898, while the corner was incubating, Mr. Leiter was the hero of the American farmer. Deputations waited upon him to thank him for the benefits he had conferred on agriculture. A more profitable price was at last to be had, and large areas were put under wheat. But this farmer's friend was also an enemy of the people, and the benefits he conferred on agriculture were the cause of his ruin.

From about this time America loses its dominating position. The starting of regular shipping lines all over the world has conferred on other countries the benefits which cheap transport conferred on America; by bringing them within reach of the open market. We are, therefore, tending more and more to rely for our supplies on several wheat producing countries instead of on one alone. Argentina, Australia, Canada, India, and Russia, are becoming extremely important to us in this respect, and are furnishing an increasing quantity of grain. The supply from each one of these countries, it is true, is unreliable. The Argentine crop is subject to devastation

by locust pests. Australia suffers from drought, which recently produced the following remarkable results :—

Imports of wheat from Australia.	
1902 . . .	2,072,766 cwt.
1903	30 „

India is no less uncertain on account of weather conditions. She exports only that part of her crop which is left over after satisfying the needs of her immense population, and these exports are scarcely less variable than in the case of Australia :—

Imports of wheat from India.	
1899 . . .	8,192,200 cwt.
1900	9,400 „

The Canadian harvest too, is uncertain as regards quality because of the short summer and quickly ripening grain. It is for this reason, peculiarly susceptible to rust and other diseases, for a quickly ripened fruit is rarely very hardy. But with a number of supplies in different parts of the world, it is extremely unlikely that all will fail in any one year. Indeed it is probable that bad weather in one part of the world must be compensated by good weather in other parts. To use a simile put forward by a recent writer on this subject, the world's wheat producing countries are no longer a team with only one crack batsman; but are like a good all round team in which some members are sure to come off in every match.

Corresponding with this steadying of the yield of wheat, is a levelling of the price between one year and another. It can no longer be said that any one source is predominant, for a world market is growing up, to which supplies come in at different seasons from many parts of the world. This is illustrated by the following table, giving the date of harvesting of the leading wheat crops of the world.

DATES OF HARVESTS IN DIFFERENT COUNTRIES.

January	Australia, New Zealand, Argentine, Chili.
February	India.
March	India, Upper Egypt.
April	Mexico, Cuba, Lower Egypt, Syria, Persia, Asia Minor.
May	North Africa, China, Japan, and Southern United States of America.
June	Mediterranean and Southern France, Central and Eastern United States of America South of 40°.
July	France, Austria, Hungary, Southern Russia, Northern United States of America, Ontario, and Quebec.
August	England, Belgium, Netherlands and Germany, East Canada.
September	Scotland, Sweden, Norway, Russia.
October	Finland and Northern Russia.
November	Peru, South Africa.
December	Burma, South Australia.

This continuity of supply throughout the year, tends to prevent violent oscillations in price, for it is found that a probable or actual failure of the crop in one part of the world does influence the acreage under wheat in other parts.

The wheat situation in the last few years has, however, borne a very striking resemblance to that at the time of the Leiter corner. History has in fact repeated itself, for whereas the figures of the world's wheat crop have been showing no great increase, the demand for wheat has been expanding at a progressive rate. The causes of this increase are the same as before. In the United States the consumption has risen from about 37,000,000 qr. in 1880-83, to 67,000,000 qr. in 1905-07, and she is beginning to import wheat from Canada. The town population of Germany is rapidly acquiring a taste for wheaten instead of rye bread, and her needs are outstripping the growth of home supply. She is consequently becoming a large importer of Russian wheat. In other countries of Europe the standard of living is also rising, and wheat is replacing rye and potatoes. Even Japan and China are beginning to consume the European staple, though at present the consumption is confined to the upper classes.

Two years ago these factors caused a squeeze in the world's market, and in the last two or three months of 1907 prices rose rapidly in anticipation of a shortage. Fortunately for the consumer, Argentina came to the rescue with a bumper crop which was harvested in the spring of 1908 and prices rapidly became normal. At the end of 1908 there was a more serious shortage. Many countries had short crops, and the requirements of importing countries were unusually large. Again, in the following spring Argentina did her best, but this time her surplus was not abnormally large, and she was not able to make up the whole deficiency. American supplies failed almost entirely, and prices continued to rise. British farmers who had wheat to sell made a good profit, and the retail price of bread advanced throughout the country. The very slight fall which followed Mr. Patten's operations in Chicago indicates that the rise of prices last year was almost entirely due to this world shortage, and not to the manipulations of the Chicago Board of Trade.[1]

[1] Mr. Patten's operation was not a "corner" of the same magnitude or importance as Mr. Leiter's in 1898. In September, 1908, wheat for delivery in May, 1909 (May option), was quoted in Chicago at 86 cents per bushel. By the beginning of April, 1909, "May options" were quoted at 127 cents per bushel. Mr. Patten was popularly supposed to have caused this rise by holding up fabulous quantities of wheat. He probably held very little actual wheat at all, but made a fortune by foreseeing seven or eight months beforehand that the world's supply would be short in the early summer of 1909.

The situation in the summer of 1909 was a difficult one; but in the most critical months, those immediately preceding the harvest, the situation (again from the consumers' point of view) was saved by very large shipments from India, which had a good surplus for export.

The world's harvest of 1909 has proved very much better than its predecessors of 1907 and 1908, and, in particular, the yields in Russia and North America have been abundant. Prices have been firm, for Germany is demanding more than ever, and stocks have become very depleted in the two lean years which have now passed.

In the preceding pages we have traced the history of wheat prices during the nineteenth century. An examination has been made of the changes which have occurred in the conditions of supply and demand, and it has been indicated that the rise in the price of wheat is, in part, a movement common to all commodities, and, in part, a result of the widening of the demand for wheat, and of a restriction of old sources of supply. Further, prices now no longer depend on the weather in one part only of the world. For the British agriculturist, as for farmers all over the world, the problem is how to support himself in lean years, when the value of his produce is low, thanks to large crops elsewhere. To some extent, the British farmer has been compensated by the fall in rent of corn land and the reduced cost of harvesting, though the small area under wheat shows that the balances require further adjustment. In past centuries it was often the case that a small yield was more remunerative than a large one, but now there is no longer any temptation for him "to hang himself on expectation of plenty." To some extent the problem may be solved by mixed farming, the farmer being compensated for a bad grain harvest, let us say, by a good root crop. The question has also been partly evaded by cultivating produce not easily sent from a distance, such as fruit and vegetables. But these devices are useless when the conditions make a single cereal crop cultivated year after year a necessity.

In a rather different way, also, something has been done to make the yield more steady. Better drainage prevents some of the damage of floods; and the wider dissemination of meteorological intelligence, especially in harvest time, has enabled the farmer to make the most of fine weather, and to limit the damage caused by rain.

It remains to consider whether the future level of prices will be sufficient to encourage wheat growing in the country. Prices are becoming steady; but is it, on the whole, at a remunerative level? We have seen that the demand has steadily increased with the growing town population of the

world. It must, however, be remembered that a rising standard of comfort only means a demand for wheat in its initial stages. When the peasant or poor artisan, who formerly ate rye, begins to improve his economic position he takes to eating wheaten bread. But he soon gets all the bread he requires, and any further rise in his income simply means a greater expenditure on meat and on his other requirements. In England, for example, the consumption of wheat per head can hardly be expected to increase much more. The world's demand is, in fact, not an insatiable one.

We have, however, a long way to travel before the limit is reached, and, meanwhile, we may ask what are the prospects of supply. More, perhaps, than half the wheat-sown area of the world yields under 15 bushels an acre, while a large proportion gives under 10 bushels. The margin between such yields and that of over 30 bushels obtained in this country will, no doubt, be slowly made up in such backward countries as Russia, as agricultural knowledge spreads and the condition of the peasantry improves. In such countries there is a latent capacity for enormously greater supplies than are now produced; it only needs the steady pressure of demand to draw them forth. Other such sources of a suitable supply may be found in South America, the Canadian North-West, Siberia, and other parts of the world, though, perhaps, the best, and certainly the most conveniently situated of the possible wheat fields of the world, have been already tapped. Still, the present upward tendency of prices is bringing more distant territories within range of the market, and if only labour can be obtained these areas will add very rapidly to the available supply. Again, the discovery of wheat that will ripen in the short summer of northern latitudes would add to the result.

These considerations lead us to believe that although the demand is increasing at a very rapid pace, yet there is ample provision for a long time to come. The question is whether the world's supply will respond at once to the call for more wheat; and the experience of the past summer suggests that it will, and that the big margin mentioned above will fairly readily be brought into use. If this view is correct, future wheat prices may be expected to remain steady, as in the past, but at a slightly higher level than in the later decades of the nineteenth century. Some inducement must be offered for the spread of wheat cultivation; but with such inducement offered the response may be expected from all quarters of the world.

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THE LONK.

As the Royal Agricultural Society of England, in conjunction with the Royal Lancashire Society, is holding its show for 1910 in Liverpool, it seems desirable to give, in this present volume, an account of the only breed of sheep, possibly the only variety of live stock, indigenous to the County Palatine of Lancashire.

This breed of sheep—the Lonk—is found on the extensive range of hills, whose watershed for many miles forms the boundary of Yorkshire and Lancashire. It is known to have been for long peculiar to the district, and is popularly supposed to have existed there from time immemorial. In the *Farmers' Magazine* for 1869, there was published an article by the grandfather of the present writer from which the following quotation is taken.

"The name they bear is purely provincial and indicates not only the local habitation but the antiquity also of the race. In the vernacular of the olden time, Lancashire was pronounced Lonkashire."

"The old form of the first syllable now survives only in the name then given to, perhaps, the only animal of the kind found able to exist upon these lone border hills, peopled successively in still more early time by the wild boar and wolf, the moosedeer, stag and roe."

Animals such as the sheep referred to in the *Farmers' Magazine* of over forty years ago, which had been able, under many disadvantages as to soil, climate, and locality, to live and multiply, could not have been other than hardy and prolific. They must, however, have had all those marks which the struggle for existence of many generations would inevitably leave behind.

It is as stock, sprung from ancestors thus reared, that the Lonk of the present day must be judged. No mountain sheep can ever compare with the lowlander if judged by standards which fail to give credit for qualities essential to earning a thrifty living on the "fell." The narrow though deep chest, the long and powerful leg, are as inconsistent with the canons of symmetrical proportion accepted by him who feeds "downs" on clover and turnips as they are necessary to the animal that grows a fleece and rears lambs on the exposed mountain pasture.

In 1861 at the show which was held by the "Royal" in conjunction with the Yorkshire Society, the Lonk may be said to have made his first appearance before the world at large. At this show the Lonk "Mountain King" took the first prize offered by the Yorkshire Society for aged mountain rams, and attracted the attention of Dickens in *All the Year Round.* He says of him :—

"There was a ram, the Mountain King . . . with vast spiral horns, a black speckled face, and picturesque as any deer, as active as any goat."[1]

[1] *All the Year Round*, Vol. VI., page 280.

This ram is described in the *Farmers' Magazine* by Mr. Jonathan Peel as follows :—

"He possessed qualities rarely found in combination, large in size but admirable in symmetry, wide in the loin, well-fleshed throughout and deep in the chest—that great point in a mountain sheep—his breast rivalling the bosom of a first-class Warlaby shorthorn, with a splendid head from which grew horns that measured 42 inches from base to tip, clothed with a coat of long fine wool, which one year throughout his whole length reached down to within 6 measured inches of the ground, and weighed in the scale a good 18 lbs."[1]

At the same show a pen of Lonks took the first prize for mountain ewes. In 1862, the year of the great exhibition, we find at the Battersea Show held conjointly by the "Royal" and the "Highland" Societies, that the two premiums offered by the English Society for mountain rams were taken by Lonks, and that two pens of the breed were entered in the class for mountain ewes, one of which obtained first prize. From 1863, when Lonks were victorious at Worcester, till 1879 the Royal Society ignored the existence of Mountain Sheep in their catalogue. In 1887, however, we find classes allotted to the Lonk breed for the first time in the history of the Society.

At Smithfield, the Lonk first made his debut in 1862 among other mountain sheep, and was victorious ; later, we find the breed successful at this show in the years from 1862 to 1866, and in 1868, 1877, and 1878, since which date Lonks have not been shown at Smithfield.

In 1865 three rams and a pen of ewes were sent to the Highland Society's show at Inverness, where they were entered in a class for "Long-Wools," Leicesters and Cotswolds being also eligible. Of this unusual occurrence a writer remarks :—

"Spectators were puzzled and judges were confounded at the sight of these animals so incongruous, placed together in the same classes. The Council were referred to for instructions. After much consideration the misplaced Lancashire sheep were excluded from competition, but were nevertheless awarded two special prizes of £5 each."[1]

Though Lonks have only comparatively recently come before the general public, yet in their own district there have long been classes for them at the local shows.

In 1881, the Lancashire Society first gave them a class to themselves, though for many years previous to this date they had been exhibited in "mixed classes."

There exists in Lancashire at the present day a cup won by a Lonk ram at the Whalley Agricultural Society's Show—perhaps the oldest show in the country—in the year 1811.

Points of the Breed.

The head, which is very characteristic, should be black, or white, or black and white. The favourite face colour is

[1] *Farmers' Magazine*, May, 1869.

black, with distinct white markings, brown or mottled faces being objected to. These markings, together with great depth and strength of lower jaw or chap and a pronounced "Roman nose"—points strongly insisted upon by breeders—give a handsome and picturesque appearance, perhaps unrivalled among all our breeds of farm stock. This fine head, which should show width both between the eyes and over the nostrils, must carry massive and well-placed horns. Great attention should be paid to how the horns are placed on the skull. They should be set on wide apart at the base, should come from the skull nearly level with the top of the head, and have curl enough not to meet the cheek. The breeder believes that a strong horn showing quality—that is, a clean horn with not

Head of Shearling Lonk Ram.

too many puckers on it—denotes that strength of constitution without which his favourite sheep is unable to battle against the many adverse conditions found among his native hills. The horns curl once or twice according to age.

The head and horn should be well set off by an eye standing well out, showing a fine and bright colour.

Width of neck and loin are insisted upon, and as far as is possible narrowness of the shoulder is to be avoided. If this defect, characteristic of hill sheep, cannot be altogether eliminated, depth through the heart and well sprung ribs must always be typical features in the frame of the well-bred Lonk.

The tail, which in the ram is always undocked, must be strong, wide, and long; in many well-bred lambs it not only

reaches, but drags along the ground. The legs, which should be black and white in colour (too much white being often looked upon as an indication of "softness"), should be well formed, strong, and showing ample bone.

A good Lonk ram combines length and straightness of back with the general appearance of a neat and active sheep, and he should walk in a graceful manner.

The wool, which should come well up to the horns and down to the knees and hocks, is exceedingly fine in texture, close or thickly set with no flake or curl. The wool when washed has a very fine silky appearance, is perfectly white, and is very valuable for the manufacture of various fine goods.

The skin should be of a fine pink colour, with no black or brown spots, and it is just behind the horns that these are apt to make their appearance.

This year (1909) the fleece off a breeding ewe running in a flock on the Fell was sent unwashed for examination to the Bradford Technical Institute. By the courtesy of Professor Barker of that institution we are enabled to give the following report :—

"Weight, 7 lb.; quality, 44 to 46's; yield of clean wool, 78 per cent. With reference to the fineness of fibre, this is not above the Lonk average. The quality is fairly uniform throughout, but kemps are fairly prevalent in certain sections. The colour is satisfactory, and the weight is about the average.

"Compared with black-face this fleece is freer from kemps, is finer in fibre, much more uniform, not quite so long, and will yield rather less of clean wool. The wool from the shoulders and back is satisfactory, but the britch is low in quality, and kempy."

Management.

The following account applies to the hill farms, which alone are the true homes of the Lonk.

The Ewe Flock.—The tup is generally put to the ewes at the end of October so that they shall lamb down in April. While with the tup they are generally on poor hillside pastures or "coppies."

After tupping is over the ewes are sent on to the "fells" or moors, where they remain till Christmas, the tups sometimes being run with them. If the weather is very rough they are then allowed to run where possible from the fell to the coppies, and a little hay may occasionally be given. This very often cannot be done, as many farms only have a "fell right," which means that several flocks belonging to different owners are all running together on one large fell.

About ten days or so before lambing, the ewes are brought down into the best pastures and meadows, the best being often very poor. Just before lambing they will probably get some hay, and perhaps a little corn, though many a Lonk goes through life without tasting "proven," as corn is called locally.

After lambing, which is generally done in the open, they remain with their lambs for three or four weeks in the lowlands. At the end of this period the great majority of the ewes and lambs are sent on to the fell. From these wild pastures they are brought down only for such functions as washing and shearing (which usually takes place towards the end of June), and for dipping. By August the lambs are generally weaned, and are then run on rough pastures. At the beginning of September all the sheep are collected, and the culled ewes are sold as "owd ewes." The remainder of the flock goes back to the fells till tupping time.

Lonk Gimmers.

The Lambs.—Those lambs which look like making tups are kept down in the pastures with their mothers, as are also the lambs which are to be fed out as fat during the summer; these latter are seldom castrated. Even these specially selected lambs and their dams very seldom get more than what they pick up on the best grass land.

It used to be the custom to keep such wether lambs as did not get fat in the summer until they were three or four years old. Most of this time was spent on the fell, and then, after two months' feeding on good grass and provender, they would weigh up to 30 lb. a quarter—a three year old wether off Longridge Fell weighed 25 lb. a quarter; this sheep was only fell-fed. At the present date the more general practice is to

feed off the wethers at eighteen months old, at which age they should weigh 15 to 20 lb. a quarter.

The grass-fed fat lambs dropped in April should hang up 40 to 50 lb. carcass weight by the end of August, but they are often ready six weeks earlier. Tup lambs are generally sold privately in August, though there are always a good number presented at the sale of pedigree sires held at Holme towards the end of September.

Ewe lambs, or "gimmers," are sent for their first winter into the lowlands along with the wethers which are to be kept on as shearlings, as at this age these lambs are unable to stand the rigours of the fell climate. The charge for wintering, which includes their keep until mid April, is from 6*s.* to 7*s.* 6*d.* per head. Such lambs chiefly go into the lowlands of Lancashire, though those bred in the neighbourhood of Halifax go into Cheshire.

From the above it will be seen that Lonks are easily managed, the Lonk being his own best shepherd—except when they are being got up for exhibition, in which case more attention is necessary. They are good feeders, and with little trouble will take almost any provender that is offered to them.

Smithfield Weights.

The weights previously quoted only refer to commercial sheep. At the Great Metropolitan Christmas Show a pen of shearling wethers have been weighed to average 216 lb. or over 15 stone each. The last pen of three shearling wethers which appeared at the Smithfield Club Show in 1878 weighed 4 cwt. 3 qrs. 26 lb.

The quality of mutton is extremely good, it having the advantage of a large proportion of lean to fat. It is absolute heresy in Lonk territory to suggest that Southdown mutton can be compared with that of this breed.

Fertility.

The Lonk is a good breeder, often yielding two and sometimes three lambs each. On a high farm an average yield of lambs should be from 100 to 125 per cent., while on lower hills they should certainly average 125 to 150 per cent., and in the lowlands 150 to 175 per cent.

This year a Lonk breeder, well known in the showyard, obtained fifty-one lambs from twenty-seven ewes, some of the ewes being shearlings. Sixteen out of the twenty-seven produced doubles, and four triplets. Another farmer obtained twenty-four lambs from twelve ewes, and in a third case thirty-seven ewes had sixty-eight lambs, eleven with singles, twenty-one with doubles, and five with triplets.

In these instances the ewes had rather better quarters than the average.

But, even in the case of show stock, sheep are sent on to the Fell for a short time. This seems to straighten them up, and the Fell also appears to provide an antidote to foot rot.

A pure bred Lonk ewe, well known to the author of this article, attained her twenty-first year this spring (1909). She has had a total of thirty-five lambs, all of which lived to "eat grass." Nine of these were triplets, and she had her last lamb in June, 1906.[1]

The Weight of Wool.

A fleece from a good wether hogg should weigh 7 to 9 lb., and that from a good "gimmer" hogg 6 to 7 lb.; whilst a ewe's fleece will be between $4\frac{1}{2}$ and 6 lb. All these weights refer to washed fleeces. Sheep that are well kept produce considerably more than this; for instance one year four prize gimmers clipped 12 lb. each.

Crossing the Breed.

From the article in the *Farmer's Magazine* already quoted we get an account by the late Mr. Jonathan Peel of his experience in trying to get an improved hill sheep by means of cross breeding.

> "It seemed so easy," he writes, "and so natural to correct their faults and make good their shortcomings by crossing them with sheep possessing those good gifts which nature had denied them.
>
> "With a portion of the flock a cross was taken with the Southdown. It was intended to return the produce to the Lonk tup and to be guided as to the future by the result. The experiment was thoroughly tried out but failed. It was repeated with the Shropshire downs; it failed again. The observation of Mr. Rowlandson that 'the crosses with heath sheep, having in view the improvement of the progeny as *heath sheep only*, have proved decided failures' is fully confirmed by my own dire experience. If greater relative width had been given to the loin, if the general outline of the animal had been somewhat improved, it was at a great and grievous cost. Everything else was sacrificed. The produce was small and stunted, too tender to maintain themselves upon the moor or to grow the wool necessary to defend them against the weather. . . ."

Lonks have gone as far as Sutherlandshire and the Grampian ranges between Perthshire and Argyllshire in some instances as a wool cross. The produce of crosses of this kind exhibited at the show of the Highland Society held at Stirling in 1864 were much admired, the wool being manifestly better, while the form of the animal was not altered.

The "draft" ewes from the Fell farms are sold to go into the lowlands, where they are crossed with Leicesters and Wensleydales. Lincolns, Cotswolds, Southdowns, and Shropshires have also hit pretty well, but they have seldom been

[1] This ewe died in August, 1909.

tried. Hampshires and Oxfords have also been used and their progeny come out well.

The produce from the Hampshire cross readily fatten and are ready for the butcher by June.

The following is taken from the judge's report of the farm competition in this journal for the year 1883.

"A flock of fifty Lonk ewes had sixty-four lambs by an Oxford down ram. This seemed to the judges to be the greatest success in crossing that they found anywhere. The second cross were really fine sheep and had much of the Oxford down character. The best of the single lambs had been fattened. . . ."

This refers to Lowland shepherding, as do all the successful crosses spoken of. When the Lonk or her progeny is wanted for the fell, to graze on heaths and very scanty grass, no outside blood has proved a success.

SHOWS AND FAIRS.

The following are the Agricultural Societies which have classes for Lonks:—

The Royal Agricultural Society of England, the Royal Lancashire, Worsthorne, Hebden Bridge, Newchurch, Colne, Keighley, Chorley, Whalley, Whitworth, Cliviger, Crawshawbooth, Saddleworth and Wardle.

Fairs.—Todmorden, Lundbutts, Moses Hall, Marsden, Meltham, Hayfield, Glossop, Holmfirth, Buxton, Whalley Bridge, Worsthorne, Woodhead, Penistone, and Haslingden, are the principal centres for the disposal of the breed.

The Lonk Breeders Association,[1] which was started in 1905, holds an annual sale of pedigree sires at Holme.

Such then is the story of the Lonk. They live and die knowing nothing of a turnip, for throughout the Lonk district roots are seldom seen. This district comprises the wet hills of Roburndale, Trough of Bowland, Slaidburn, Newton, in the West Riding of Yorkshire; Pendle Hill, the hills about Darwen, Haslingden, Bacup and Rochdale, Burnley, Worsthorne, and Colne, in East Lancashire; the hills above Keighley, Bradford, Halifax, Dewsbury, Huddersfield, Saddleworth, Barnsley, and Penistone, in South West Yorkshire; also the hills above Buxton, Bakewell, and Chesterfield, in North Derbyshire, and in some parts of Cheshire. These hills have a scanty covering of bent and ling, and vary in height from 800 to 1,900 feet.

Such even now is the home of the Lonk, where for centuries he is believed to have led his hardy life. So runs tradition: and tradition, vague and faint, forms his sole history. Youatt does not mention him, and Culley confuses him with the "Blackface."

W. RALPH PEEL.

Knowlmere, Clitheroe.

[1] Secretary, J. C. Ashworth, Overtown, Cliviger, Burnley.

PEDIGREE SEED CORN.

IT is proposed in the present article to consider the following propositions :—

1. Along with active investigation of the principles of heredity there is proceeding considerable increase in the number of varieties and races of the cereals.

2. Some existing varieties and races of each of the cereals have been well proved to give crops of much higher value to the grower than others of the same species, and still better combinations of good characters in new races may be expected.

3. Definite evidence is needed of the suitability of varieties and races to locations and soils, and in this connection the cumulative effects of natural selection in modifying the racial character of the cereals must be taken in account.

4. Much better comparisons can be made of both yield and quality between distinct varieties and pure races than between aggregates of fluctuating composition.

5. It is desirable to consider whether a scheme of co-operative and co-ordinated trials in different localities of existing varieties and of new pure races of the cereals as they appear, and also a system of registration of them would have advantages alike to plant breeders, seed distributors, and growers.

A considerable proportion of the seed corn used in the United Kingdom consists of mixtures of many varieties and races.

In some parts of the country these mixtures result in aggregates of more or less well-marked types. For instance, most of the barley grown north of the Tay is such a mixture of races known as "Scotch Common," whilst in some parts of Ireland a not very dissimilar aggregate known as "Old Irish" is grown. Such similarity as different growths of these so-called "varieties" present are doubtless the result of the exchange of seed corn being generally limited to the district or to prolonged cultivation under approximately similar external conditions. In other words, these aggregates have become what they are at present mainly by the action of natural selection. We may call them "local varieties," at the same time remembering that the term "variety" has

no precise definition. Barley of this class is described in Germany as "landgerste" (*i.e.*, "the barley of the land"), in contradistinction to "Chevalier gerste," "Goldthorpe gerste," &c., for varieties the origin of which is known, and the characters well defined.

Local varieties have been to a great extent replaced in the larger corn-growing districts by a large number of distinct varieties and more or less "pure races" of each of the cereals, *differing from the former in that the individual plants making* up the several aggregates are much more uniform. There is, however, of course, a constant tendency for these stocks also to get mixed. At the same time, it must be admitted that some of them differ from others in little more than name.

So much has recently been written on the subject that it is not necessary to enter with much detail into past and present methods of raising distinct varieties and pure races of the cereals. Briefly, however, it may be noted that most of those at present in cultivation are the progeny either of single plants or of a limited number of similar plants selected originally from local varieties or mixed races with or without resort to artificial crossing. The method of raising a stock from a selected individual plant (of a species which is normally self fertilised), without artificial crossing, gives rise to a "pure race," the individuals of which (apart from such accidental mixture as is inevitable, or from "sporting," which is very infrequent with cereals under normal conditions) differ only in consequence of the effects of external conditions, which do not affect the racial character of the stock.

A plant or plants selected from the progeny resulting from a cross may or may not give rise to a uniform "pure race," according as the plants selected are or are not genetically homogeneous in respect of every structure of the plant in which there was unlikeness in the original parents, or, stated more simply, are "fixed" in respect of all characters.

Recently the extension of the work of Mendel has led to more complete (although still far from complete) understanding of the principles of heredity in cultivated plants, to much more ready combination of characters and to much more systematic methods of selecting individuals, resulting from cross-fertilisation, from which to raise pure races with fixed characters.

Of this development as applied to cereals, Professor Biffen, working at the University Farm at Cambridge, has been the pioneer in this country. I have had the advantage of collaborating with him in respect of barley; and many others are also at work on similar lines in this and other countries.

It appears certain that in the future continued selection, by no means superseded (rather, indeed, rendered more necessary

by the new developments) plus hybridisation on Mendelian lines, will lead to the production of many new races of cereals possessing desirable and fixed combinations of characters.

There is, however, obviously no advantage from the point of view of growers in putting into cultivation new races unless they are better than older races, and from the point of view of millers, maltsters, and other grain consumers, multiplication of sorts is a disadvantage. There are certain well-established standards of quality associated with existing varieties, and undue multiplication leads to confusion. In the interests of both growers and consumers, the existing races best suited to the different localities and soils should be adhered to until superior ones are discovered.

That there are very substantial differences in average yield as between existing races of cereals in particular localities, is well established. Taking briefly the case of barley by way of example : in Denmark, in Ireland, and in Norfolk, long series of variety tests have, as is generally agreed, proved a particular type of barley, called "Prentice" on the Continent and "Archer" in England, to have the best cropping capacity. The same general proposition is true of wheat and oats. In any particular locality, and for the same type of soil, a jury of growers would probably give a unanimous verdict that certain named varieties were in average seasons better yielders than others. Generally, also, these would be the most profitable.

There is less unanimity with regard to the average quality of the grain of different varieties because in the valuation of this the knowledge or even perhaps in some cases the prejudices of the consumer comes in to complicate matters. Modified processes of manufacture also lead from time to time to altered values being put upon different grain characters.

The subject of the adaptation of certain varieties or races to the climate and soils of a particular locality is of very great interest. It is also very complex, and our knowledge on the subject is almost wholly empirical. A grower has frequently no *a priori* knowledge to indicate whether any new variety well spoken of in some other district is likely to give good results on his land. It is known, for instance, from accumulated experience that Red Fife wheat is rarely as good a cropper as many other sorts in most parts of England, but nobody knows why. In some few locations the yield has compared well with other sorts. The milling quality is, of course, much above the average, but very rarely does the extra quality compensate for the low yield.

In other cases experience has led to the fairly definite conclusion that some existing varieties of each of the cereals are, and some are not, adapted to particular soils and localities.

"Spratt" barley is a typical case. It has a stiffer straw than any other British variety, and on rich loamy soils gives very heavy yields, often more than compensating for the usual low quality of the grain. It is therefore grown successfully in the Fens, but it is found to be out of place on soil well adapted to grow good malting barleys. Similar cases with other cereals are known to every corn grower.

This accumulated experience, however, takes a long time to gain, and moreover, with the introduction of systematic methods of hybridisation, we are entering on a new era. If the best is to be made of the new methods of cereal breeding, some uniform and reliable methods of testing at least for yield in different localities seem highly desirable. However good in various respects as to special characters these new sorts may be, they are unlikely to be profitable unless it can be definitely established that they yield as well as older sorts.

Moreover, the climatic conditions of districts vary so greatly from year to year that one or two years' experience is rarely conclusive. For instance, "Goldthorpe" barley did well for a few years in north and east Norfolk, but in one dry season some years ago there was a widespread loss of crop owing to ears breaking off, the common failing of many "wide-eared" sorts, and now it is scarcely grown at all in that district. On the other hand this class of barley is well established in Shropshire, in Scotland, and in Yorkshire, and suffers little in this respect in either locality.

A large number of "variety tests" of cereals have been carried out by various public bodies in various parts of England but have generally been too isolated and not prolonged enough to be of practical value to growers.

In many cases also because experimental errors have not been obliterated by the only possible method, viz., simultaneous multiplication of test areas, these errors have probably been large enough to vitiate the results.

In view of the inevitable increase of new varieties and races, it appears pertinent to put in a plea for co-operation, co-ordination, and systematic methods of variety testing of cereals under the direction of some recognised agricultural organisation.

It is very important to know what is being compared. It is useless to simply compare two bulks of seed that are differently labelled unless the labels correspond to something definite in the ancestry of the plants, and unless the growers interested can be sure of obtaining stocks of the same races as those compared. For these purposes a system of registration of stocks of pure races of seed is suggested. Such is already in successful operation in Germany, and will be referred to later.

The foregoing general statement in support of the opening propositions may be met by the objection that there is insufficient evidence that "pedigree" seed corn is so much more valuable than the mixed races which form a large part of our present stocks as to justify such special efforts.

Mixed Seeding.

There is a good deal to be said in favour of sowing "mixtures." In the *Agricultural Gazette* there recently appeared some interesting references to the sowing of "mixed wheats." One writer adduces the results of practical experiences in favour of the practice, and justly gives as the reason in its favour that "all varieties have naturally different requirements," and that a mixture has the advantage of "utilising more thoroughly the resources of the soil." Professor Wrightson commenting on this agreed on general grounds, specifically mentioning a mixture of "Lincoln Red" and "Squareheads Master." Both authorities, however, infer that the mixtures should be designed and not merely accidental, and the isolation of distinct varieties and some knowledge of their several habits is therefore postulated.[1]

Mixing varieties and even species of the cereals is very ancient agricultural practice all over the world. In many parts of India nearly all the grain crops to this day consist of mixed species of cereals.

Going back to old British agricultural practice, Thorold Rogers finds frequent reference to "drage" and "drage malt" in Manor Rolls of the thirteenth century and onwards. "Drage" was evidently a very commonly grown crop. Although Rogers considered "drage" to be an inferior kind of barley, it is certain that it was really the same mixture of barley and oats which is still called "dredge corn" in the south and west of England.

On the subject of mixing different varieties of wheat, two hundred years ago Edward Lisle, perhaps the most observant agriculturist who ever left his observations on record, wrote: "Mr. Johnson, of Bedfordshire, of whose judgment I have a great opinion, was under certain conditions inclinable to sow great wheat and red straw wheat mixed that the former might help to support the latter from lodging and falling, and he has known great wheat and red straw wheat often sown in the north in good land for the same reason."[2]

There seems no doubt that mixtures of different species very frequently yield a greater total produce on given area

[1] *Agricultural Gazette*, November 1, 1909, page 418; *ibid.*, November 22, 1909, page 486.

[2] *Observations in Agriculture*, pp. 74, 81.

than would either of the species alone. The same may hold good of mixed varieties or mixed races of any one species when compared with seed of a pure race, unless the latter has been bred with special reference to the average external conditions of the locality.

There is, however, a great difference between (i.) a "designed" mixture of varieties and (ii.) the aggregate which results from either (*a*) natural selection in a district where "pure races" have not been introduced (*e.g.*, Scotch Common Barley) or (*b*) the aggregate resulting from indiscriminate mixtures of pure races.

A good deal of the seed corn used in some parts of England is of the latter class, and this state of things comes about more particularly in districts where one "type" of barley is found to be generally suitable, but where this type is represented by a number of distinct races which, possessing different racial characters affecting prolificacy, yet closely resemble each other in appearance, sometimes when seen as plants, and even more frequently when seen only as grain. For instance, the barley grown in Yorkshire is nearly all of the "wide ear" type, but this type is represented by at least half a dozen well known races, some (Goldthorpe for one) known to be pure races raised from single self-fertilised plants, others (like Standwell) resulting from cross fertilisation in the first instance. There is very little doubt that a considerable proportion of the seed barley used in Yorkshire is a mixture of these different though externally similar races.

Chevallier and Archer barley again are frequently found mixed, although in this case there is a distinct structural difference in the seed (to say nothing of the generally obvious difference in the straw) which entitles the two sorts to be classed as distinct "varieties." This particular mixture is not likely to give good results in most seasons. Archer has about a week longer growing period than Chevallier, and even ripening is of great importance with barley.

Effects of Natural Selection.

It is interesting to consider what happens when mixtures of different races are sown, and seed taken in successive years from the previous crops.

It is evident that the character of the resulting aggregate after some years depends mainly on such natural selection as goes on in the field. The effects of natural selection on the racial character of our cereals is worthy of more attention than it has hitherto received. It is not, of course, possible here to go into the subject exhaustively, but merely to indicate

how considerable and sometimes rapid effects on the racial character of aggregates may be produced.

Let it be assumed that one only out of four seeds sown reproduces grain. This will be the case with barley if the crop of grain is twelve and a half times the quantity of seed sown, and if the average number of grains on each plant producing grain is fifty ; a sufficiently near approximation to average field results.

Let it be further assumed by way of example that there is sown a mixture composed of 25 per cent. each of four distinct races, A, B, C, D, and that the resulting crop shows the above ratio of crop to seed, viz., 12·5 : 1.

The four races will certainly differ in cropping capacity. If planted separately it is probable that the extreme difference in weight of grain on equal areas would not be more than 10 per cent., but with the very severe competition involved in the obliteration of three out of four seeds or plants at some stage between sowing and harvesting, and taking into account the inevitable differences in adaptation of the several races to the conditions of soil, climate, and cultivation, it might well happen that the ratios of grain harvested to seed sown might be A, 5 : 1, B, 10 : 1, C, 15 : 1, D, 20 : 1, giving 12·5 : 1 as an average. If the average number of grains produced by each surviving plant is fifty, a ratio of even 20 : 1 for the most vigorous race means that more than half the seeds or plants of even this race have failed at some stage.

If seed is taken from the resulting aggregate and resown, and the process continues under the same conditions and with the same ratio of reproduction for each race in each year, a simple calculation shows that in three years A, instead of forming 25 per cent. of the crop, will be represented by less than 1 per cent. In six years B also will be reduced to below 1 per cent. of the whole, whilst A may survive to the extent of about five plants per acre, C will survive considerably longer, but at the end of fifteen years the total of A, B, and C together will be less than 1 per cent. of the crop, A and B being then almost obliterated. The crop will be practically a pure race of D.

Even if the ratios of reproduction of different races are only slightly different, the same result will occur if the ratios are steadily maintained, and sufficient time elapses.

Suppose, for instance, the average ratios of grain produced to seed sown to be A 12 : 1, B 13 : 1, A and B forming equal proportions of the aggregate at the start, and the produce to be sown year after year, in twenty years the aggregate will be five of B to one of A. In fifty years there would be fifty-five of B to one of A, and in a hundred years 3,000 of B to one of A—practically a pure race of B.

Needless to say the constant external conditions above postulated are never actually maintained, and therefore the conditions of different years are favourable to different races. Notwithstanding this a consideration of such purely hypothetical cases as the above leads to the conclusion that, whilst in some cases quite rapid changes in the racial character of aggregates occur, in other cases fairly uniform varieties may have arisen in course of time from mixed types.

For instance, Chevallier barley as we have it now is probably all descended from the "few ears" (to use Chevallier's own words) from which the variety was originally raised in 1823. We know nothing about the ancestry of these "few ears," but it seems extremely probable that the present uniformity of all the differently named Chevalliers now in cultivation is largely a consequence of natural selection. There have been from time to time many reselections, but the progeny of these are all very much alike in racial characters. It is practically impossible to distinguish these different selections when they are growing together, and the prolonged series of Danish experiments to be referred to later failed to show any appreciable difference between several of them in either yield or quality of grain.

This is not, of course, to say that repeated "pedigreeing" of a good variety is not desirable. It is indeed obviously necessary if the racial character of the grain is to be maintained against the operation of all the factors which make for divergence from the original type.

It has been fairly well proved by Johannsen that maintenance of established characters is all that can be effected by reselection within an absolutely pure race of self-fertilising cereals, and that increased productiveness is not obtainable by selecting the most productive individuals. This is, of course, a statement in a special case of the application of the doctrine which has now been very generally accepted, that characters acquired by the individual from effects of environment only are not inherited. This doctrine as a general formula is still in dispute, but such knowledge as we have is in favour of its application in the case of self-fertilising cereals.

The best piece of evidence in this connection is perhaps afforded by the history of Major Hallett's Pedigree Races. In the case of his pedigree barley the most prolific plant has been selected year after year for a great number of years, and forms the starting point of a "pure race." The very desirable effect has been produced of maintaining absolute uniformity, and there is no evidence so far as I am aware that the progeny of the later selections differs from that of the

earlier, either in respect of the characters of the grain, or of prolificacy, or any other racial character.

We may now briefly consider the effects likely to be produced by natural selection in the case of mixed races, pure races, and hybrid races of cereals respectively.

Take first the case of a mixed race introduced into and grown on for several years in a particular locality and under approximately similar conditions from year to year without further admixture. One or more of the types of which the aggregate is composed will probably be better suited than the others and survive under the average conditions, and, with three out of the four of the seeds sown in each year failing to reproduce grain, there may accrue a considerable difference in the character of the aggregate even within a few years, whilst after several years the aggregate may be of quite a different racial character to the original bulk. The general tendency, however, would be towards homogeneity in consequence of some types disappearing.

Let a stock of this modified aggregate be transferred to another district with quite different soil, climatic and cultural conditions; then if there is left out of consideration for the moment the immediate effect due directly to change of locality, the particular race or races which have best survived the previous conditions, and which make up the greater part of the aggregate, may or may not be better suited to the new conditions than some which have nearly died out, and after a few years the new conditions may remould the racial characters of the aggregate either in the direction of greater homogeneity, or at first (if only the smaller proportion of the aggregate in that best suited to the new conditions) towards greater heterogeneity. Ultimately, however, the tendency will be again towards a more or less homogeneous aggregate, differing however, probably in general character, both from the original and from the transferred aggregates. All this agrees with the observed fact that a "change of seed" sometimes gives good results at once, sometimes after a year or two, and sometimes not at all.

Consider now the case of a "pure race"—the progeny of an individual plant—introduced into cultivation in a particular locality. So long as this stock is kept free from admixture and neglecting "sports," and also accidental cross-fertilisation, both of which are very rare with wheat, barley, and oats, the aggregate will remain homogeneous. The yield and quality will of course vary from year to year, but such crowding out of individuals as takes place will not affect the racial characters, and it is obvious that if these are constant, the question whether this particular race is suited to the average

conditions of a locality can comparatively soon be determined by comparison with other varieties and races in cultivation under the same external conditions.

Transferred to another environment the uniformity will be maintained, although the comparative yield and quality may be altered.

Now suppose some of this pure race to be taken back and seeded in its original habitat, will the quality and yield be different from that obtained from seed of the *same* pure race which has been grown there continuously?

A series of experiments bearing on this point has been made by the United States Department of Agriculture, and the results were recently given by Dr. Le Clerc, of the Bureau of Vegetable Physiology, at Washington, in a paper to the British Association. The American results dealt with the characters of the grain only. They showed that no difference in *quality* was traceable to what may be called "previous place effects." That is to say, that a series of plots alongside, seeded with grain all of the same *original* race, gave crops of similar quality, notwithstanding that the seed for each plot was grown the previous year in widely different localities, and was of widely different quality in consequence. The "quality" of the seed (so far as it was due to "place effects") was not transmitted. Only the "racial" characters were transmitted to the crop, and these were the same with the same race wherever the seed used was grown. It would be generally agreed that this accords with the general experience that within a particular race "quality" is determined by the immediate external conditions. I have made a series of similar experiments on a nursery scale at Warminster, and my results confirm the above with regard to quality.

With regard to "yield," however, I have consistently in three following years found with one particular pure race of barley (and there seems no reason why this should not apply to any other race) significant differences in *yield of grain* due to the environment in which the seed was grown the previous year. For instance, with the particular pure race referred to (raised from a single plant in my nursery at Warminster in 1902), the resulting crop was heavier after the seed had been transferred to and grown on a strong clay loam, than after it had been grown on a poor chalk marl, when both were brought back to the original soil and grown alongside under precisely similar conditions. The explanation of difference in yield in one generation after a change of locality, as between two parcels of the same original race, can apparently only be put down to the fact that the seed itself brings with it something due to the soil or climate in which it was grown, which is useful to the

young plant during the earlier period when it depends for nutrition on its own endosperm content. In the following year, when the progeny of both parcels of seed were resown I found no significant difference of yield, and there was of course no evidence that the racial character had been changed by the effects of environment. This instance is only of interest in this particular connection as illustrating one of the precautions necessary with reference to changes of locality when making "variety tests" of yield. It may be noted also, however, in passing, that effects of "change of seed" (well recognised in all ages in a vague and general way to be of great importance), is evidently a matter calling for more systematic study.[1] It is certain that change of locality may lead with mixed races to a complete alteration of the racial character of the aggregate. On the other hand it may possibly give a result the first year after transferrence, due merely to physical differences in the seed not affecting racial character, this latter being probably the only result to be expected in the case of a pure race.

Lastly, What effects of natural selection may be expected with a hybrid cereal race?

It is doubtful at present whether we can be quite certain that any single plant selected from the progeny resulting from cross-fertilisation, as the starting point for a new race, will give us a pure race which is constant in the same sense as when there has been no crossing. Even if the Mendelian hypothesis of unit characters is fully accepted, there are evidently so large a number of "characters" which may be genetically different to a greater or less extent in the original pair of parent plants, that some amount of "splitting," especially in the characters which are not obvious (or which normally fluctuate widely with environment), may go on but pass unnoticed. Further experience will no doubt lead to greater certainty in extracting completely fixed individuals from amongst hybrids, and no one can see fields of some cereals now in general cultivation, which originally started from hybrids, and especially some of Professor Biffen's hybrid wheats without feeling sure that they are—at any rate for all practical purposes—uniform. If, however, genetic (as distinct from fluctuating) variations do take place, these will, as the result of crowding out, be either established or eliminated in the aggregate in the course of time, according as the conditions are favourable or not to the survival of the individual plants in which they occur.

On the whole it seems probable that with aggregates resulting from the progeny of hybrids, there will be more risk

[1] Lisle considered that "the changing of all seed whatsoever is of as much use and service as half the dung sufficient for a crop." Observations in Agriculture, 1757, page 83.

of alteration of type through the action of natural selection, than with absolutely pure races started from single individuals which have not resulted from previous crossing.

The conclusion, and this is well confirmed by general experience, is that whatever the origin of any race of cereals, repeated artificial selection is necessary to maintain its uniformity.

A further important point to note is that purely natural selection does not, in the case of mixed races of cereals, necessarily, or indeed probably, bring about increased rate of grain production, or even lead to a maintenance of the rate.

The plants which survive in every field of mixed races of corn are not necessarily or even probably those of the most prolific (that is, abundant seed-bearing) race. We grow our cereal crops mainly with the object of producing grain, rather than straw, but the competition between crowded plants is mainly in the vegetative stage, and it is not, either with the cereals or with most other species of plants, the good seed-bearers which are necessarily the most vigorous and the most likely to survive in the vegetative stages.

Another series of experiments in my barley nursery at Warminster illustrates this point.

In 1906 seed from four pure races of barley grown in the nursery for several previous years were taken. Three of these were wide-eared races of the Goldthorpe type, and the other was one of a Danish Prentice (*i.e.*, Archer) barley, called "Tystofte."

Alternate rows of each of the four races were repeated thirty times. Rows were at equal distances and plants at equal distances, giving each plant equal soil space. Each of the rows was weighed up separately at harvest. The "wide ear" race which adjoined "Tystofte" in each group gave a higher average grain produce per row by nearly 50 per cent. than "Tystofte." Mr. W. S. Gosset kindly examined statistically the figures for the weights of the grain in each row, and found that the probability, taking into account the "standard deviation" of individual rows from the mean, was enormously in favour of the "wide ear," being more prolific under the conditions than "Tystofte," assuming that there was no "interference" of the one sort prejudicial to the other. Mr. Gosset's examination of the figures for all the four races showed, however, that there was abundant evidence of "interference," and on his suggestion in the following year, 1908, these two races were grown, not in alternate rows, but in alternate plots repeated twenty times. The field of "Tystofte" was 10 per cent. better on the average than of the wide ear, and the odds, taking each plot separately into account under these conditions, was very greatly in favour of "Tystofte."

The multiplied nursery plot experiment was repeated in 1909 with substantially the same result, and field trials also gave confirmatory results.[1]

The explanation of the apparently contradictory result as between alternate row and alternate plot planting in this case is both obvious and instructive, as bearing on the operation of natural selection in cases of mixed seeding. The alternate-row planting in 1907 may be taken as a case of mixed seeding. The effect evidently was to crowd down the race, which, when sown unmixed, was the most prolific. "Tystofte" has about a week longer growing period in an average season than the wide ear, but is also four to six inches shorter in the straw. There is no doubt that in this case there was crowding down of the slower growing and ripening variety by the taller-strawed, quicker-growing (though normally less productive) variety, which over-topped and shaded the other in the grain-forming stage.

There is, in fact, afforded an illustration in respect of varieties of what would be generally accepted with regard to the effect of natural selection in the case of species, viz., that in a population of mixed species of different habits, it will not necessarily follow that the species which reproduce most abundantly when living apart will survive under conditions of free competition with other species.

The foregoing illustrations seem to warrant the proposition that in order to determine an "order of merit" of any more than a quite temporary value as between aggregates of seed corn, comparison must be made between, at least approximately, pure races. Aggregates of fluctuating composition are in a state of unstable equilibrium, and comparisons between them give no results of general utility.

We may conclude this part of the subject by saying that the whole problem of mixed versus pure races of cereals is very much on a par with the same problem in respect of farm live-stock.

Pedigree stock is best if the average external conditions of the locality are more favourable to the particular race than to others, but except under these conditions may easily be less profitable than an aggregate made up of mixed breeds.

[1] I have some evidence to show that series of small scale nursery cultivations under precise conditions, supplemented by biometrical methods of interpreting the significance of the results obtained, may turn out to be of value for determining the relative prolificacy of new races of cereals. The method is obviously more economical than that of field plots for comparing large numbers of new races, such as the progeny of hybrids. I hope shortly to publish some account of the cultivations carried out at Warminster, with a view to systematising this method.

"Pedigree" gives to the grower and the breeder alike the "quality" of the produce which they require to the extent that this is determined by racial characters. Whether or not it gives vigour of constitution and productivity depends on suitability of the "breed" to the conditions.

In both cases, however, without pure races in which the racial characters are constant, and which therefore can be systematically compared, we are groping in the dark in endeavouring to obtain better adaptation of races to different sets of average external conditions.

Variety Testing.

In several other countries more attention has been given than in Great Britain to systematic "variety testing" of cereals. This is, of course, not to say that this country has been behind other countries in the raising of good varieties and races of the cereals. The present plea is not for the production of new and improved races which is proceeding as rapidly as our knowledge admits of, but for their isolation and for better means of judging of their adaptation to local conditions.

What has been done with maize in the United States affords one of the best illustrations of the value of variety testing. This crop is, of course, of enormous importance in the States. The total area is over a hundred million acres—computed by the United States of America Department of Agriculture to have had a value of over 300 million pounds in 1908, a much greater annual value than that of the whole annual agricultural produce of all kinds in this country.

In several of the great maize growing states variety trials were commenced more than twenty years ago under the direction of the State Experiment Stations. There is a great mass of literature on this subject, and the recent operations in one of the principal maize states will afford a good example both of the method and value of well-organised systems of "variety testing."

The state of Indiana grows about 4½ million acres of maize (three times the English acreage of wheat). The variety tests are directed by the Purdue University Experiment Station at Lafayette.

Out of many hundred different varieties grown in different parts of the United States, twenty had been proved after a series of trials, in past years to give good results in various parts of Indiana.

For the purpose of the more recent trials, the state was divided into twelve districts. To a number of growers in each district a set of five out of the twenty varieties of maize are sent annually. The number of growers reporting on these

sets of varieties in 1908 was 245. There are therefore twelve different groups of comparisons of five varieties, each group comprising a considerable number of separate trials. Most of the varieties are included in the sets sent to more than one division. All the seed of each variety is from one growth within the state, and generally within the division. From time to time varieties which have been well tested and found deficient are omitted and new ones added.

It is, of course, impossible to give the results obtained in any detail, but I have arranged a summary of them in the following table.

The last report gives the yields obtained on each farm for three years 1906-8, and it also gives the average "growing period" of each variety in each division of the state. The table, in the form in which I have arranged it, brings together average "yields" and "growing periods," and justifies a general conclusion (not expressly noted in the report, in which the figures are not summarised in this particular way), which transpires from a comparison of the two sets of figures.[1]

Except in two divisions of the state the variety with the longest average growing period gives the highest average yields. The exceptional divisions are those in the extreme north, near the shore of the great lakes. Here the variety with the shortest growing period gives the highest yield. It is clear from the general distribution of maize that this part of the state is near the northern limit of the maize-growing area, and it is probable that either early or late frosts rule out all the varieties except those which require the shortest period in which to mature.[2]

This result accords with general experience in the case of other cereals, viz., that the varieties of any cereal with as long an average growing period as the climate of the locality admits of, are those which give generally the highest average yields.

The "average days growing period" for maize in Indiana varies with each variety, and in each division of the state. The extreme limits being 104 days for "early yellow Dent" (No. 1 in Div. 1 & 2), which is grown only in the four most northerly divisions of the state, and 133 days for "Johnson County White Dent" (No. 5 in Div. 8 to 12), grown in the more southerly divisions. The results clearly bring out the fact that the determinations of the average growing period of each variety is of value to the growers.

[1] Purdue Univ. Agr. Expt. Station Bulletin 132, 1909, pages 470-486.

[2] The table gives the average yields in 1908 only, these being the only strictly comparable figures for all the varieties tested, but the averages of the previous years bear out the same general conclusions even more strongly.

Variety testing of Maize in Indiana, 1908.

Division of State	No. of sets of trials	Yield of varieties tested in each division arranged in order of length of growing period — Average bushels per acre: 1st	2nd	3rd	4th	5th	Lowest	Highest
1	8	41·0	37·3	37·4	37·5	37·3	37·3	41·0
1a	6	39·4	39·7	38·4	43·8	37·3	37·3	43·8
2	21	49·9	49·3	49·6	53·1	51·2	49·3	53·1
2a	14	45·5	43·7	44·8	44·1	45·0	43·7	45·5
3	12	49·9	50·9	52·3	51·3	56·8	49·9	56·8
4	21	52·1	55·1	53·1	56·6	57·4	52·1	57·4
5	19	45·0	44·1	45·8	45·6	48·4	44·1	48·4
6	19	49·1	46·9	48·8	51·3	52·8	46·9	52·8
7	13	46·9	47·8	46·6	48·0	49·1	46·6	49·1
8	19	43·4	43·7	39·6	40·0	41·9	39·6	43·7
9	19	41·6	42·8	42·1	43·2	44·2	41·6	44·2
10	18	46·3	47·1	45·6	48·6	51·0	45·6	51·0
11	31	39·1	41·9	42·0	43·3	44·8	39·1	44·8
12	25	35·5	37·6	35·0	36·2	40·4	35·0	40·4
Mean		44·6	44·8	44·4	45·9	47·0	43·4	48·0
Average		45·3					45·3	
Per cent. above or below average		—1·5%	—1·1%	—2·0%	+1·3%	+3·7%	—4·2%	+5·9%

The differences in yield as between the varieties is very significant if it is remembered that to each division of the state the five varieties believed to be the most suitable for the district were sent. When the averages for each of the twelve divisions are brought together there is shown an average difference between the highest and lowest variety sent into each division of over four and a half bushels per acre, equal to over 10 per cent.

It should be also noted that each of the figures in this table represents the average of the combined results obtained by from six to thirty-one different farmers, whose names and locations are given in the report, and their neighbours are therefore in a position to obtain seed from them of those races which appear likely to be most profitable in the several districts.

Each grower also notes in his report the variety which he considers best adapted to his farm, which is generally but not invariably that which gives highest yields in his particular case.

The United States Department of Agriculture in its reports has frequently claimed that the enormous expenditure of public money involved in its operations is more than justified by practical benefits which it would be impossible to obtain through

individual efforts. It may be worth while to look at these particular results from the point of view of possible benefit obtained compared with expenditure involved.

The average yield in all the trials of 1906-7-8 was 53 bushels per acre. The United States Department of Agriculture estimated the average crop of the state of Indiana for these years at 35½ bushels. No doubt, however, the trial plots, in addition to good seed, had also in many cases the advantage of selected farms and selected fields. However this may be, the total value at the farms of the maize crop of the state of Indiana in 1908 is estimated by the United States Department of Agriculture at 16½ million pounds. The cost of the Indiana experiment station (carrying out research and demonstration work also in many other subjects) to the United States Treasury is about 4,000*l.* per annum, and to the state itself about the same amount in addition. This would therefore be more than regained by the maize growers of the state alone if the information derived led to an average increased yield of only a few pounds per acre; and after allowing for every possible experimental error, it appears fairly certain that the state derives more than full value for the cost of the investigation.

It is, of course, impossible to dissociate the factors which affect the average production per acre, but a study of the statistics of grain acreage and production in the different states of the Union brings out some interesting facts. Here again detail is impossible, but it is significant that those states, of which Indiana is one, where the local experimental stations are most active in "variety testing," are those in which average estimated produce per acre is increasing most, as it is increasing in several of the eastern and middle states, notwithstanding the fact that the bringing into cultivation of fresh virgin soil has practically terminated, and a process of soil exhaustion is going on. For the ten years 1896-1905 the estimated yield of maize for the state of Indiana was 34 bushels against 29 bushels for the ten years 1886-1895. Only in the adjoining maize states of Illinois and Ohio are anything like these estimated increases shown, and in both of these states similar variety testing to that in Indiana has been going on for over twenty years. The estimated average yield in the whole of the United States was 23·4 bushels in the first period and 25·9 in the second.

Whatever may be the verdict on the value of any particular set of variety trials, it is certain that a very valuable part of the work of the United States Department of Agriculture has been the demonstration of the fact that to get the best profit from corn growing, not only good soil conditions, but also the best type of each species is necessary.

Coming nearer home similar work in other countries, and with climates more like our own, may be briefly referred to.

Sweden.—The Seed Station at Svalof in Scania is probably at present the most completely equipped organisation in the world for the breeding and study of the cereals. The investigatory part of its operations is supported by a grant from the State. A number of valuable new races of wheat, barley, and oats have been raised there, and a large proportion of the grain now grown in Sweden consists of these pure races. This organisation provides not only for the raising of new races by selection under a most complete system, and in later years also by hybridising on Mendelian lines, but also for continuous testing of these races in different districts in comparison with older varieties in respect of yield and quality. There is an independent commercial department working in association with the station which distributes seed of pure races. Many of these have become well established in other parts of Europe and in America.

Denmark.—The system of "variety testing" of barley adopted for a long series of years by the Royal Agricultural Society of Denmark was described in a paper to the Farmers' Club in 1905.[1]

Here also there is abundant evidence of the value of the results to the grain growers of the country. Many thousands of comparative tests have been made, and the system adopted is a model for all such trials in respect of continuity and method. The last estimate of the average yield of barley in Denmark is considerably higher than in Great Britain, although the climatic conditions are certainly not more favourable.

Ireland.—The Department of Agriculture in Ireland commenced an extensive series of variety tests of barley in 1901.

The results have been fully reported on from time to time in the publications of the Department, and recently a compilation of them, entitled "Barley Cultivation in Ireland," has been written by Mr. A. McMullen. Very definite conclusions have been arrived at with regard to the respective values of different varieties, and the Danish results have been fully confirmed.

It would appear to be proved that the same races of barley were generally most productive in both countries, and these races are now rapidly superseding others in many parts of Ireland.

There can be no doubt that these trials have been of great benefit to the barley growers of Ireland. The average

[1] Beaven: "Yield and Quality of English Barley," *Journal of the Farmers' Club*, December, 1905.

yield of barley in Ireland last year as estimated by the Department of Agriculture was 43·8 bushels of 56 lb. per acre, as against the estimate of the Board of Agriculture of 33 imperial bushels per acre in Great Britain. For the previous ten years the estimated yields were :—Ireland, 35·8 bushels of 56 lb.; Great Britain, 33·1 imperial bushels. The exceptional difference last year was, of course, largely due to a more favourable season in Ireland, but there is very little doubt that the work of the Department in variety testing has had a considerable effect in improving barley cultivation in Ireland as by general consent it has had in other directions.

Germany.—"Variety testing" has been conducted in recent years on an extensive scale by the German Agricultural Society, and by local societies acting in co-operation with the larger society. There were in all 573 sets of trials in 1908, and of these 543 were of cereals.

Registration.

In addition to "variety testing" the German Agricultural Society carries on an extensive establishment which undertakes the registration, inspection, "recognition," and distribution of seed on behalf of its members. These operations were described at length in an article in the Journal of the Board of Agriculture (June, 1909). Briefly stated, the register ("Saat-gut Angebote") serves the purpose of notifying to growers where seed of pure races may be obtained.

This society fulfils in Germany the same function as our own greater agricultural societies, and in addition to these the branch of its operations dealing with seed corn appears to have been particularly successful.

It is only proposed here to deal with the question of registration in a tentative manner, and to put forward some of the more apparent pros and cons. The establishment of any such system would be an innovation in this country, and any objections which might be raised should be fully considered before any responsible society decided on initiating any similar scheme.

Putting aside that part of the operations of the German society which deals with actual distribution, some of the other methods, and more particularly registration as applied to cereals, appear possible of imitation with advantage in this country, with perhaps some limitations and not improbably some improvements.

It does not appear probable that the distributive part of the system (although it need not necessarily involve trading competition) would commend itself for adoption in this country, nor does this appear to be any more a necessary

part of a system of registration than would be (to take as near a parallel case as can be quoted) any commercial transactions on the part of the various "breed" societies who register our pedigree herds and flocks.

Any scheme which might be adopted should take into account the interests not only of growers, but also of seed raisers and distributors. It would probably begin in a comparatively small way. The number of growers of pedigree cereals is limited, and whilst isolation of pure races and means of identification may be important, many growers will remain satisfied with the more or less indefinite aggregates which at present form the larger part of the seed corn used in this country. The business of dealing with these parcels would remain practically unaffected by any system of registration, since this could apply only to those established varieties which have been kept practically uniform by either their originators or others to whom the original stock has been transferred, and to new races raised by selection or hybridisation, and it would appear that such a system would be distinctly beneficial to those engaged in the production and distribution of this class of seed corn.

It is suggested that any register which was started should be published periodically, and consist of two parts: (i.) a description of the distinguishing characters of the variety or race; (ii.) a list in two classes of—

A. Original growers of distinct varieties or pure races, or those to whom the whole original stock had been transferred.

B. Second-hand growers obtaining seed direct from growers registered in Class A, with the year when the seed was obtained.

The German system of "inspection" and "recognition" might or might not be added, or might be optional to those growers willing to pay the charges which would be involved.

A system might also be added for collection of samples of ripe crops of registered varieties, comprising entire plants (grain and straw) representing the produce of say $\frac{1}{1000}$ acre taken in aliquot parts from several parts of the fields or plots of registered varieties. These might form standard samples of convenient size for storing for reference, and might also, moreover, provide a collection of examples for exhibition.

Any such systems of registration, recognition, inspection, sampling, and exhibition would, of course, require careful consideration and working out in detail, and possible abuses of them should be provided against. This could only be attempted with any hope of success by some organisation commanding the confidence of agriculturists generally, and

also of the seed distributing industry, and it would probably be agreed that it would work best in this country on entirely voluntary lines.

The historical, as distinct from the immediate practical, value of such a register would be considerable, and might perhaps in future be comparable to the present value of existing registers of pedigree animals. The present need appears to be further ventilation and discussion of the subject in its various aspects.

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CONTEMPORARY AGRICULTURAL LAW.

IT is proposed in this article to notice the enactments of the Legislature during the past year and the principal decisions of the Courts during the same period, which are of importance to those engaged or interested in agriculture.

I.—LEGISLATION.

During the parliamentary session of 1909 there has been no Act passed so directly affecting agricultural interests as the consolidating Agricultural Holdings and Small Holdings Acts, passed in the previous session of 1908. There are, however, two Acts of 1909 which are likely to be of considerable importance to agriculture. The first of these, the Housing, Town Planning, &c., Act, 1909 (9 Ed. 7 c. 44), is divided into four parts. Part I. deals with Housing of the Working Classes, Part II. with Town Planning, Part III. with County Medical Officers, &c., and Part IV. is supplemental. Part I. so far as it may affect the supply of houses for agricultural labourers alone, requires notice here. Section 1 extends Part III. of the Housing of the Working Classes Act, 1890 (53 and 54 Vic. c. 70), which enables local authorities to provide dwellings for the working classes in districts where there is, by the failure of private enterprise or from other causes, a dearth of accommodation, to every urban or rural district. The powers conferred by the Act of 1890 may therefore now be applied by any urban or rural district council without the necessity of any formal adoption of the Act. Section 2. enables a local authority to purchase land compulsorily for the above purpose, and notwithstanding that land is not immediately required for the purpose, by means of an order submitted to and confirmed by the Local Government Board. The procedure for obtaining a compulsory order is stated in the first Schedule, and is much the same as that under the Small Holdings and Allotments Act,

1908. If objection is made to the compulsory order a local inquiry will be held, at which the parties interested may appear, but counsel may not be heard or expert witnesses called, except when authorised by the Board. The objectionable provision of the Small Holdings and Allotments Act, that an order when once confirmed by the Board is to become final, as if enacted in the Act, is repeated, and the jurisdiction of the courts to question the validity of an order is thus ousted. See the case of *ex parte Ringer*, which exemplifies the mischief of this clause, and is quoted hereafter. The question of compensation to the owners and occupiers of land taken will be referred to a single arbitrator, appointed by the Board, who may not make any additional allowance on account of the purchase being compulsory. Under Section 10 the Local Government Board have power to enforce by mandamus the exercise of their powers by any local authority in cases where such powers ought to have been, and have not been, exercised, and under Section 12 a County Council may act in default of a Rural District Council if satisfied that the latter body ought to have and have failed to exercise their power. Under Section 14, in the case of a contract for letting for habitation a house or part of a house at a rent, elsewhere than in London, or in a large borough or urban district, not exceeding 16*l*., a condition will be implied that the house is in all respects reasonably fit for human habitation and under section 15 an undertaking will also be implied that the house shall, during the holding, be kept by the landlord, in all respects, reasonably fit for human habitation. Section 44 gives a much needed power to the Local Government Board, if satisfied by local inquiry or otherwise that the erection of dwellings for the working classes in any district is unreasonably impeded in consequence of any by-laws in force therein, to require the local authority to revoke such by-laws or to make new by-laws.

The second new Act of Parliament which requires notice is the Development and Road Improvement Funds Act, 1909 (9 Ed. 7 c. 47). It enables, by Section 1, the Treasury, upon the recommendation of Development Commissioners appointed under the Act, to make advances to a Government department or through a Government department to a public authority, university, college, school, or institution, or an association of persons or company not trading for profit, either by way of grant or by way of loan for any of the following purposes: (*a*) aiding and developing agriculture and rural industries by promoting scientific research, instruction and experiments in science, methods and practice of agriculture (including the provision of farm institutes), the organisation of co-operation, instruction in marketing produce, and the

extension of the provision of small holdings, and by the adoption of any other means which appear calculated to develop agriculture and rural industries; (*b*) forestry (including (i.) the conducting of inquiries, experiments, and research for the purpose of promoting forestry and the teaching of methods of afforestation; (ii.) the purchase and planting of land found after inquiry to be suitable for afforestation); (*c*) the reclamation and drainage of land; (*d*) the general improvement of rural transport (including the making of light railways, but not including the construction or improvement of roads). For the purposes of the Act five Development Commissioners are to be appointed (sec. 3), and every application for an advance under this part of the Act must be sent by the Treasury to the Government department concerned, to be by them referred, together with their report thereon, to the Development Commissioners (sec. 4). The department, body, or persons to whom an advance is made for any purpose involving the acquisition of land, may acquire and hold land for the purpose, and if unable to acquire by agreement on reasonable terms, may apply to the Commissioners for an order empowering them to acquire the land compulsorily, but no land may be authorised to be acquired compulsorily which forms part of any park, garden, or pleasure ground, or forms part of the home farm attached to or usually occupied with a mansion house or is otherwise required for the amenity or convenience of any dwelling-house. The Commissioners, in making an order for the compulsory purchase of land, must have regard to the extent of land occupied in the locality by any owner or tenant, and to the convenience of other property belonging to or occupied by the same owner or tenant, and must, so far as possible, avoid taking an undue quantity of land from any one owner or tenant, or displacing any considerable number of agricultural labourers or others employed on the land; (sec. 5). Disputed compensation on the purchase of land in England will be assessed by a single arbitrator, appointed by the Lord Chief Justice, and the Act does not contain the provision already noticed which appears in the Housing Town Planning, &c., Act, and which prevents a court of law from questioning the validity of an order for compulsory acquisition. The expression "agriculture and rural industries" in this part of the Act includes "agriculture, horticulture, dairying, the breeding of horses, cattle, and other live stock and poultry, the cultivation of bees, home and cottage industries, the cultivation and preparation of flax, the cultivation and manufacture of tobacco, and any industries immediately connected with and subservient to any of the said matters" (sec. 6). Part II. of the same Act constitutes a Road Board, empowered to make advances to

highway authorities in respect of the construction of new roads or the improvement of existing roads, and also themselves to construct and maintain any new roads which appear to the Board to be required for facilitating road traffic (sec. 8); they may acquire land for the purpose of constructing a new road, and may, in addition, acquire land on either side of the proposed road within 220 yards from the middle thereof (sec. 11). There is a saving provision as regards commons, open spaces, and allotments, which may not be acquired under the Act compulsorily except by provisional order confirmed by Parliament, except where the order provides for giving in exchange for such land other land not being less in area certified by the Board of Agriculture and Fisheries to be equally advantageous to the persons, if any, entitled to commonable or other rights, and to the public; but this provision does not apply to the acquisition of common land for the purpose of forestry, if the order provides for the granting to the public of reasonable access to the land, for air, exercise, or recreation, or to the acquisition of any common land, for the purpose of the construction of a new road or the improvement of an existing road within a rural district (sec. 19).

There are also two minor enactments of the session of 1909 which affect agriculture. One is the Board of Agriculture and Fisheries Act, 1909 (9 Ed. 7 c. 15), which gives power to appoint a second secretary to the Board who "shall not, by reason of his office, be incapable of being elected to or voting in the Commons House of Parliament." Sir Edward Strachey has been appointed parliamentary secretary of the Board under this Act. The other is the Diseases of Animals Act, 1909 (9 Ed. 7 c. 26). which requires local authorities, for the purposes of the Diseases of Animals Acts, 1894 to 1903, to pay to veterinary surgeons or veterinary practitioners a prescribed fee not exceeding 2*s*. 6*d*. in respect of every notification of disease made to the local authority or to any officer of the local authority in pursuance of an order under those Acts requiring notification.

In connection with recent legislation, the case of *ex parte Ringer* (7 L.G.R., 1041; 73 J.P., 436) is of considerable importance, and may here be noticed as showing the arbitrary effect of the provision for the compulsory acquisition of land in the Small Holdings and Allotments Act, 1908, which is repeated in the Housing, Town Planning, &c., Act, 1909. Mr. E. H. Ringer held Whissonsett Hall Farm, in Norfolk, which had been occupied by himself and his family for many years. It comprised 363 acres of heavy land, on which it was impossible to keep sheep during the winter months. In April, 1908, he bought a farm, containing 181 acres of light land, suitable for sheep, and

precisely the kind of land which could be worked in conjunction with the Hall Farm. On October 8, 1908, he also purchased the Hall Farm, which he had formerly rented, though, as he stated, he would not have purchased it had he not secured the light land farm. After purchasing the two farms he had enlarged the farm buildings at the Hall Farm, in order that he might work the two farms together. For the working of the Hall Farm only the enlarged buildings were unnecessarily large. The Norfolk County Council served notice of an order, under the Small Holdings and Allotments Act, 1908, for the compulsory purchase by them of the whole of the light land farm for allotments, and the Board of Agriculture and Fisheries, notwithstanding Mr. Ringer's objections, confirmed the order. Mr. Ringer then applied to the Court of King's Bench for a rule calling upon the Norfolk County Council to show cause why a certiorari should not issue to remove, for the purpose of quashing it, the order for compulsory purchase, on the ground that the order had been made in disregard of Section 41 of the Act, which forbids the taking of an undue or inconvenient quantity of land from any one owner, &c. This was refused, on account of the provisions of Section 39 (iii.) of the Small Holdings and Allotments Act, 1903, whereby it is enacted that an order for compulsory acquisition under the Act, when confirmed by the Board of Agriculture and Fisheries, "shall become final and have effect as if enacted in this Act; and the confirmation by the Board shall be conclusive evidence that the requirements of this Act have been complied with, and that the order has been duly made and is within the powers of the Act." The Court therefore held that it was prevented from having jurisdiction to entertain any questions in respect of the validity of any order already confirmed by the Board of Agriculture and Fisheries, the order having become *ipso facto* final, and having the effect of an Act of Parliament. The Judges pointed out that the Board is placed in a position of absolute supremacy by the Act, and the powers and jurisdiction of the Courts of Law are consequently entirely ousted when it has once confirmed a compulsory order for purchase or hiring. The Scottish case of *Stewart* v. *Williamson* (1909, Sess. Cas., 1254), which deals with Section 11 (i.) of the Agricultural Holdings (Scotland) Act, 1908, which corresponds with Section 13 (i.) of the English Agricultural Holdings Act, 1908, is also important. The Court there held that the section applies to a valuation of sheep stock between landlord and tenant at the expiry of lease, and that the value of the stock must be therefore determined by a single arbitrator under the section, notwithstanding that the lease may provide for a different mode of valuation.

II.—Decisions of the Courts.

1. *Labour.* There have been many decisions on points arising under the Workmen's Compensation Act, 1906, though only a few of these especially concern agriculturists. In *Rowland* v. *Wright* (1909, 1 K.B., 963; 77 L.J.K.B., 1071), it was held by the Court of Appeal that where a teamster in the course of his employment was taking his meal in the stable, and one of the stable cats flew at and bit him, and the bite resulted in serious injury, the accident arose "out of and in the course of his employment," and that he was therefore entitled to compensation from his employer for the injury. In *McLean* v. *Moss Bay Iron and Steel Company* (1909, 2 K.B., 521; 78 L.J.K.B, 849), a man married the mother of an illegitimate child, not being himself the putative father. The three lived together, the son paying all his wages into the common family fund. The son having met his death by an accident, the husband and mother claimed compensation as "dependants" under the Act. It was held by the Court of Appeal that the husband was not within the class of "dependants," and also that the mother, though within that class, could not recover, as she must be taken to have been wholly dependent upon the earnings of her husband, who was legally bound to support her. The Master of the Rolls doubted whether in the ordinary case of a husband and wife living together with other members of the family the wife can even claim, as distinct from the husband, to be dependent upon the earnings of a member of the family whose wages have gone to increase the common fund, and have not been in any way appropriated to the benefit of the mother as distinct from her husband.

Marks v. *Carne* (1909, 2 K.B., 516; 78 L.J.K.B. 853) is a decision under Section 4 of the same Act, which deals with cases of sub-contracting, and makes a person for the purpose of his trade or business contracting with another person (called the "contractor") for the execution by the contractor of any work undertaken by the principal, liable for injuries to workmen employed by the contractor. It was in that case held that a timber merchant who bought certain trees standing, and contracted with Marks to fell the same, was not liable for injury which happened in the course of felling to Marks' son, as the son, being a member of Marks' family, was not a "workman employed" by Marks. It is to be borne in mind, however, that this section does not extend to cases where the contract relates to threshing, ploughing, or other agricultural work, and the contractor provides and uses machinery driven by mechanical power for the purpose of such work. In that case the contractor only, and not the farmer employing him, is

liable for compensation for injury to any workmen employed by him.

Strong v. *Treise* (1909, 1 K.B., 613; 78 L.J.K.B., 401) is a case of a different character and deals with the employment of children in agriculture. The child was a girl of thirteen years and seven months in the employment of a farmer to assist him in dairy work. He was summoned for so employing her under the Education Acts, but was held to have committed no offence as the employment was justified by the provision of Section 1 of the Elementary Education (School Attendance) Act (1893) Amendment Act, 1899, relating to the employment of children in agriculture and a by-law made by the Cornwall County Council thereunder fixing thirteen as the minimum year for exemption from school attendance of a child to be employed in agriculture.

2. *Stock.* There have been several interesting cases which relate to a farmer's liabilities and rights in respect of his farm stock. In *Higgins* v. *Searle* (100 L.T., 280; 7 L.G.R., 640), a sow, the property of the defendant, happened to be straying on the highway without, as was found by the jury, any negligence on the defendant's part. A horse in a van passing along the highway shied at the sow, and a motor car coming in the opposite direction, to avoid running into the horse and van, turned and came into collision with a stone wall and was damaged. The owner of the motor car sued the defendant for the injury caused to his car, but it was held that in the absence of negligence the defendant, as owner of the sow, was not liable for damages in respect of the injury to the motor car. The Court of Appeal before whom the case came laid down that a farm animal straying on the highway is one of the ordinary risks taken by those using the highway, and if an accident happens owing to those risks without any negligence on the part of the owner of the animal no legal consequence follows. In this case the Court were only following a previous case of *Hadwell* v. *Righton* (1907, 2 K.B., 345; 76 L.J.K.B., 891) in which it was held that the owner of a fowl straying on the highway was not liable in damages to a cyclist whose bicycle was upset by the fowl.

Lowery v. *Walker* (1909, 2 K.B., 433; 78 L.J.K.B., 874) is a very important case dealing with the liability of the owner of a savage animal for injuries caused to trespassers. The defendant occupied a field in which he placed a savage horse which was known to have bitten people on previous occasions. The field was in fact used by people as a short cut, though there was no right of way across it, and the defendant had put up boards warning trespassers. The plaintiff, who had no permission to enter the field, was crossing it, and in so doing

was bitten by the defendant's horse. He sued the defendant for damages for the injury he had sustained and was awarded 100*l*. damages in the County Court. On appeal to the King's Bench Division this decision was reversed, the Court holding the plaintiff to be a trespasser, and laying down that a trespasser cannot maintain an action for damages sustained while trespassing in a case where the savage animal is not kept for the express purpose of attacking trespassers. A man has a right to keep a savage animal and there is no duty on him so to keep it as not to injure a trespasser. This case has quite recently been taken to the Court of Appeal, who affirmed the decision of the Court of King's Bench, holding that the fact that the defendant knew that the public habitually crossed this field without leave did not impose upon him towards persons so crossing any duty not to keep an animal such as the horse in question in the field, though one Judge (Lord Justice Buckley) dissented from this conclusion (1910, 1 K.B. 173). The result would of course have been different if there had been a right of way across the field, for it is clear that a farmer would have no right to turn an animal known to be savage into a place where the public have a right of passage, and he would be liable if he did so for any resulting injury.

There have been two cases of injury caused to stock. In *Hague* v. *Doncaster Rural Council* (100 L.T., 121 ; 7 L.G.R., 129), a stream was polluted by effluent from a sewage farm of a local authority, and three bullocks of the plaintiff died in consequence of drinking the water. It was held that the local authority was liable for the damage caused and that it was no defence to the claim that the action was not brought within six months of the death of the bullocks, inasmuch as the pollution of the stream commenced some time back and was continued until the commencement of the action, and therefore there had been a "continuance of injury or damage" which enabled the proceedings to be commenced under Section 1 (*a*) of the Public Authorities Protection's Act, 1893, at any time within six months next after the ceasing thereof. The action was therefore brought in time, as it was commenced before the act complained of, *i.e.*, the pollution, had ceased. *Torrance* v. *Ilford Urban Council* (7 L.G.R., 60, 554 ; 99 L.T., 847) was a case where a horse died from over-exertion in pulling a waggon over loose granite laid 5 inches deep on the whole width of a certain lane for a distance of 40 or 50 yards. The waggon contained a load weighing some 3 tons and was drawn by two horses. The plaintiff to whom the horse belonged alleged negligence on the defendant Council's part in the following respects : (1) that the highway was not closed ; (2) that it was not repaired in halves; (3) that no warning notice was put up ;

(4) that the road was not scarified; (5) that an excessive thickness of stone was laid over the whole road. The jury before whom the case was tried found (1) that there was negligence on the part of the defendant's servants; (2) that the driver could not by taking reasonable precautions have avoided the consequences of the negligence; and (3) that the death of the horse was the natural and necessary consequence of the negligence. On these findings judgment was entered by the County Court Judge for the plaintiff. The Court of Appeal, however, held that the plaintiff could not recover as the driver of the waggon had the opportunity of appreciating the difficulty and danger to his horses and elected to run the risk of crossing the loose granite instead of turning back. Having so elected, damages could not be recovered from the road authority, although their servants might have been guilty of negligence.

The case of *Johnson* v. *Wilson* (1909, 2 K.B., 497; 78 L.J.K.B., 912) related to the exemption of farmers from the necessity of taking out dog licences. The Court decided that where a certificate of exemption is claimed by a farmer under Section 22 of the Customs and Inland Revenue Act, 1878, in respect of two dogs "kept by him solely for use in tending sheep or cattle," the Justices are not entitled under Section 5, Sub-Section 1 of the Dogs Act, 1906, to refuse their consent to the grant of such certificate merely on the ground that they consider that only one dog is necessary for the stock on the applicant's farm. Lord Alverstone, L.J., said, "The Justices have asked us whether a Petty Sessional Court is bound under Section 22 of the Act of 1878 and Section 5 of the Dogs Act, 1906, to give their consent to two exemptions from dog duty in the case of every applicant who, being a farmer, keeps two dogs solely for use in tending sheep or cattle on an enclosed farm. The question must, in my opinion, be answered in the affirmative. Subject to the Justices being satisfied that the above-mentioned conditions for obtaining exemption are fulfilled, the applicant is entitled to exemption in respect of two dogs, and the Justices are not entitled to cut down the exemption to an exemption for one dog merely because they think that one dog is sufficient for the applicant's farm."

3. *Landlord and Tenant.* The decisions during the past year bearing on the legal relations of landlord and tenant as regards agricultural land are not numerous. *Re Viola's Lease, Humphrey* v. *Stenbury* (1909, 1 Ch., 244; 78 L.J.Ch., 128), is to the effect that where there is a lease to two joint lessees for a term of years determinable on notice by "the lessees," the notice to be effectual should be signed by both of them, and will not be good if signed by one only in the absence of proof (express or implied) of the authority of the signing lessee to

act on behalf of his co-lessee. The very recent case of *Rush* v. *Lucas* (Times, 21 Dec., 1909) is a very important decision on the right of a tenant to plough up grass land. The defendant was a yearly tenant of 215 acres of land, of which 53 acres were arable at the commencement of the tenancy. In 1895 the tenant sowed 22 acres of the arable with grass seed. In 1901 he broke up 9 acres of this and grew wheat on it, and in 1902 he again sowed it with grass seed, and so it remained until the last year of the tenancy. In 1909 the tenant received notice to quit and claimed payment from the landlord for the grass laid down, and threatened, in case of refusal, to plough up the land. The landlord then commenced an action for an injunction to restrain him from so doing on the ground that the defendant threatened to commit a breach of the covenant against committing waste or spoil or ploughing up pasture land. Mr. Justice Eve refused the injunction, holding that land arable at the date of the agreement and for many years previously had not become pasture land within the covenant, because the tenant had in subsequent years left it for a considerable period in grass. He also held that the threat to plough up the grass did not involve a breach of the covenant to farm the land upon the most approved system of husbandry. An act which would not have been a breach of this covenant if the tenant was not under notice to quit could not be converted into a breach by the service of the notice to quit. This decision is in accordance with the general opinion of tenant farmers, who consider that their liability under covenant or custom not to plough up pasture or meadow land only extends to such land as was in that condition at the commencement of the tenancy. A tenant may, therefore, under a threat to plough up grass land seeded at his own expense, indirectly compel the landlord to compensate him therefor at the expiration of the tenancy, though the Agricultural Holdings Act, 1908, gives him no compensation for laying down permanent pasture unless the previous written consent of the landlord has been obtained.

4. *Rating. Green* v. *Newport Union* (1909, A.C. 35; 78 L.J.K.B., 97) is an important decision on rating law. A sea wall had been constructed for the purpose of protecting various farms from inundation by the sea, and rent-charges were, by a local Act by arrangement, imposed upon some only of the farms protected for the purpose of maintaining the works, although these also benefited the remainder of the farms. The Court of Appeal refused to allow the deduction of any part of the rent-charges so imposed in arriving at the rateable value of the lands on which they were imposed, considering that the rent-charges did not in principle differ

from a mortgage created by a landlord in respect of which, admittedly, no deduction could be allowed. The House of Lords reversed this decision, holding that the rateable value of the lands liable to the rent-charge should be ascertained on the footing that all the protected lands, whether liable to the rent-charge or not, contributed in proportion to the benefit which they received. The Lord Chancellor said, "No doubt, if this is done, a deduction will have to be allowed on those lands which enjoy protection, but are exempt from contributing. I cannot see why this should not be so. These exempted lands have somehow acquired rights as against the other lands, whether by purchase or by some other means, in the remote past. They are, on that account, more valuable to their owners, and the contributing lands are less valuable. But the rating authority is not concerned with that." The result was that the lands affected by the rent-charge were held entitled in the assessment of rateable value to a deduction of a proportionate part of the rent-charge, though not of the whole as it was at first contended.

5. *Produce.* Under this head there are three cases dealing with the supply of milk which may be noticed. In *Tyler* v. *Dairy Supply Company* (6 L.G.R., 422 ; 98 L.T., 867), it was held that a medical officer of health, or other officer authorised by Section 3 of the Sale of Food and Drugs Act Amendment Act, 1879, to procure samples of milk in course of delivery for the purpose of analysis, has not necessarily himself to procure the samples, but may do so by his agent acting under his instructions.

Bellamy v. *Great Western and Metropolitan Dairies, Ltd.* (6 L.G.R., 772 ; 98 L.T. 757), was a case where the defendant company were prosecuted under the Weights and Measures Act, 1875, Section 25, in respect of a milk churn belonging to them, for having in their possession for use for trade a measure which was unjust. The churn was one of several churns supplied by the company for use by a farmer who sold milk to them. They were marked to indicate barn gallons, and the farmer in fact estimated the quantity of milk supplied by him from the marks, and made out consignment tickets stating the quantity in each churn accordingly. As a rule the company accepted the tickets as correct for the purpose of their accounts with the farmer, though they kept accurate measures for testing the quantity of milk if necessary, and used those measures for measuring the milk if there was any doubt as to the quantity. The secretary of the company stated in evidence that the company never measured by the marks on the churns, and never intended them to be used as measures by the farmer or

others, but only as an index of the height of the milk in the churns. There was also evidence that a churn accurately marked as a measure in the first instance, would, owing to usage to which it would be subjected in transit, at once cease to be reliable. The churn in question was examined while on its way to the farmer empty, and it was proved that the marks were inaccurate in favour of the company to the extent of 2½ pints in 17 gallons. In a case stated by the Justices, the Court of King's Bench held that there was evidence on which the Justices were justified in concluding that the churn was not used by the company as a measure, but only as a vessel for conveyance of milk, and that they were therefore right in dismissing the information. In *Lewis* v. *Weatheritt* (7 L.G.R., 502; 100 L.T. 367), Lewis was prosecuted for selling adulterated milk which was found on analysis to have had abstracted from it 14 per cent. of milk fat, and set up the defence, under Section 25 of the Food and Drugs Act, 1875, that he had purchased the article in question as the same in nature, substance, and quality as that demanded of him by the prosecutor and with a written warranty to that effect, and that he had no reason to believe at the time he sold it that the article was otherwise. He proved that the milk had been supplied by Messrs. C——, who had originally supplied him with milk under a written contract for the supply of "warranted pure new milk," and continued to supply him under a verbal arrangement under which nothing was said as to warranty of the milk, but the milk had been and was always supplied in churns, each bearing a label with the words "Pure new milk." It was held that the label constituted a warranty within the section with which the milk was bought by Lewis, and that the other conditions of the section being fulfilled this defence was good.

6. *Fertilisers and Feeding Stuffs.* *Needham & Co.* v. *Worcestershire County Council* (7 L.G.R., 595; 100 L.T., 901), was a decision on a case stated by Justices on a prosecution under the Fertilisers and Feeding Stuffs Act, 1906, which by Section 1 (ii.) requires a vendor selling for use as food for cattle or poultry, any article artificially prepared, to give the purchaser an invoice stating the "percentages (if any) of oil and albuminoids in the article." The vendor sold sharps with an invoice stating that they contained 1 per cent. oil and 1 per cent. albuminoids. This statement was erroneous, the percentages being in fact far higher, viz., 3·89 per cent. and 15·75 per cent. The Court held that the vendor had not committed an offence under Section 6 (i.) (*a*) of the Act, which makes it penal to fail without reasonable excuse to give the invoice required by the Act, as an invoice had in fact been delivered. The offence, if

any committed, was against Section 6 (i.) (*b*), which deals with the delivery of an invoice false in any material particular to the prejudice of the purchaser, but for which he was not prosecuted. If he had been, it might have been difficult to succeed, as the percentages were much higher than those stated in the invoice, and the purchaser, in fact, obtained a better article than appeared by the invoice. Lord Alverstone at the same time expressed no opinion as to whether or not sharps came within Section 1 (ii.) of the Act.

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AGRICULTURAL COMPETITION.

A PRECISE presentation of fluctuation in the supplies of agricultural commodities from foreign and colonial countries in recent years, competing with home products in our markets, would involve the tabulation of a great mass of figures, which it is considered desirable to avoid. It will be understood, then that in this article nothing more will be attempted than statements in general terms of the comparative importance from this point of view of the chief sources of our agricultural imports, together with such indications of probable growth or decline in the future as are afforded by available evidence.

WHEAT.

For a great number of years up to the beginning of the present century, the United States had been almost invariably by far the largest contributor to our imported wheat supply, Russia being usually second. This preponderance continued until 1904, when India was in the top position, Russia being second, and Argentina third. In that year our imports of wheat grain from the United States were comparatively insignificant, as they were also in the following year, when Russia, Argentina, and India, in the order given, sent us more than three-fourths of the total. In 1906 the United States recovered the top position, but had to give place to Argentina in 1907 and 1908 in respect of wheat grain alone, though not if flour be included. The last-named country first became an important exporter of wheat in 1893, since which year a great advance has been made, of course with fluctuations, the total shipments to all countries having been recently from four to five times the quantity of the year just named.

In consequence of the rapid increase of population in the United States, and the steady exhaustion of unoccupied land suitable for wheat growing, it seems probable that the exportable surplus of that country has reached its limit, except in a season of extraordinary production, although it is possible that a permanent high level of prices for that cereal, might lead to its substitution to some extent for maize, now regarded as the most profitable corn crop where it flourishes. In Argentina, on the other hand, there is an immense area of land suitable for wheat at present unoccupied, and needing only immigrants to bring it into productiveness. Russia may also increase her exports for years to come; but our share in them has always been subject to great and sudden fluctuations. This has been the case also with contributions from India, which does not promise any steady increase, if any increase at all in an average of several years.

Canada was an insignificant contributor to our wheat supply until considerable progress had been made in the settlement of Manitoba and the North Western Territories, since which time progress has been rapid and great. Both in 1907 and 1908 the Dominion was ahead of Russia, standing fourth in the former year and third in the latter. The progress of wheat-growing in the Commonwealth of Australia has been extremely slow, and the shipments to this country, except in an occasional year of great abundance, have not yet reached large dimensions, although they have more than once amounted to about one-tenth of the total. The tendency, however, seems to be towards a more rapid advance in the future. Roumania usually ranks next to Australia, but far below that source of our wheat supply.

FLOUR.

By far the most important source of our supply of wheat flour is the United States, whence we have usually received at least three-fourths of the total for many years past. There was a time when Hungary was an important contributor; but recently the receipts from that country have fallen to small dimensions. Canada for some years has occupied the second position.

When flour in equivalents of grain is added to wheat, the comparisons given above in relation to grain remain unaltered, excepting, as already stated, in connection with the United States in 1907 and 1908, when the addition of flour placed that country much above Argentina. It follows that up to the present time there have been very few years in recent times when the United States failed to stand first in supplying us with wheat in one form or another.

BARLEY.

Russia has long been the most important source of our imported barley supply, followed by Turkey in the great majority of years, but occasionally by Roumania, the United States being usually fourth, and occasionally third, through changing rank with Roumania.

OATS.

In supplies of oats Russia again has long taken the leading position, though in 1908 there was a falling off in her shipments to this country, and Argentina for the first time came to the top. The latter country has only recently become an important contributor to our imports of oats, 1907 having been the first year in which we received any considerable quantity from that source. The quantity had not previously reached half a million hundredweights, whereas in 1907 it rose to 1,645,700, and in 1908 to 5,235,800. Previously Germany, Roumania, and the United States had changed places in the order of exports of oats to this country in different years, Canada occasionally coming in as a fourth, and New Zealand once in ten years instead. Sweden, at one time an important contributor, has fallen into an insignificant one for some years past.

PULSE.

Our imports of beans and peas are on only a small scale, and they are made up of little contributions from a great number of sources, the supplies from some of them being inconstant. Thirty countries are in the list for beans, and thirty-two for peas, although our imports of the former have not reached 2,000,000 qr. for several years, and those of the latter have lately fallen below that quantity. Turkey, Egypt, and India are usually the largest shippers of beans to this country, while India, the Netherlands, Germany, and Canada send us the greatest quantities of peas.

MAIZE.

Up to 1901 the United States had supplied us with a much greater quantity of maize than any other country. Roumania in most years, but Russia occasionally, standing second in this connection. Since that date, however, except in one year, Argentina has been the greatest contributor. It was not until 1895 that Argentina began to export maize extensively, but the progress has been rapid since that year. Roumania still sends us large quantities in good harvest years, but is a very irregular source of supply, as also is Russia. Although the production of maize in the United States has increased enormously in the

last ten years, the exports have dwindled, as the great majority of growers prefer, as the saying is to "sell it on the hoof."

SEEDS.

The United States, France, Germany, New Zealand, Chile, and the Netherlands, are the chief sources of our supplies of imported clover and grass seeds. This has been the case for many years, except that Chile has not long been among the largest contributors. Cotton seed comes chiefly from Egypt and India; linseed from Argentina and India; and rape from India and Russia. Tares are most extensively supplied by Germany, Turkey, and Russia; and garden seeds by France, Germany, the United States, the Netherlands, Italy, and New Zealand.

OIL-SEED CAKES.

Linseed and cotton-seed cakes come from many countries. Taking them together, the supplies are greatest from the United States, Egypt, Russia, Germany, India, Mexico, and Canada. Russia sends all but a trifling proportion of the small quantity of rape-seed cake which we import, usually only from 5,000 to 11,000 tons.

HOPS.

The chief advance in competition with English hops in recent years has been that of the United States, and that has not been very remarkable. Belgium, the Netherlands, and Germany keep about on a level with the quantities which they sent to us ten years ago, one year with another. Competition has become keener only because the consumption has been reduced.

VEGETABLES.

France is by far the largest contributor to our imports of potatoes; but her supplies have fluctuated without increasing in the last ten years. Germany or Belgium was usually second up to 1904; but both have since fallen to a much lower place, as it hardly pays them to compete with our main crop at such prices as have been current in recent years. France, on the other hand, sends us early potatoes, which have not suffered from extremely low prices, and thus is able to continue a profitable trade. Similarly the Channel Islands keep up their supplies. The chief increase in recent years has been that of contributions from the Canary Islands.

Spain sends us from one-third to one-half of our total imports of onions, Egypt and the Netherlands following in the order of quantities.

The Canary Islands have come to the top as shippers of tomatoes to this country, having sent us over half of our

total imports in 1907 and 1908. Their consignments, however, arriving mainly in the late autumn and winter, affect English growers much less than supplies from the Channel Islands. France and Spain are extensive contributors, but not to an increasing extent.

Fruit.

We imported more apples in the five years ended with 1898 than in the five ended in 1908, and the quantities sent by the two largest contributors, the United States and Canada, were about the same each for the quinquennial periods. Australia and Tasmania have increased their quantities, while France, Belgium, the Netherlands, and Germany have fallen behind their earlier consignments.

France, Germany, and the United States supply the greater part of the pears we import. Among them only the United States have made any headway, and the exception is not important. Canadian consignments, although small, have increased, no doubt in consequence of the development of fruit-growing in British Columbia. The comparison of totals for the two quinquennial periods is the same as in the case of apples. It is also the same for plums, of which France is much the greatest contributor.

Apart from apples, by far the most serious foreign competition which British fruit-growers have to face is that of bananas, the imports of which have steadily and enormously increased. In 1900 the number of bunches was only 1,287,442, although it was well up to the average for the time. In 1908 it was 6,389,445. The increase is mainly in supplies from Costa Rica and the British West Indies, the latter of which are practically bounty-fed by our Government, by means of a steamship subsidy paid to develop the production of bananas in Jamaica.

Live Stock.

Russia supplies more than half the few horses which we import, France, the United States, Iceland, and Greenland being the chief other contributors.

Our sanitary restrictions limit the number of sources of supplies of cattle and sheep, while they practically exclude pigs altogether. Imports of cattle have dwindled in recent years, even from the few countries which can supply them now that European countries and Argentina are scheduled. For a great number of years from one-half to two-thirds of our imported cattle have come from the United States, Canada having been second in importance as a source of supply, as was Argentina so long as her cattle were allowed to enter our ports alive. The last named country was gaining ground greatly

when our ports were closed to her cattle and sheep, and there is no doubt that the progress would be continued if the present embargo were removed. Canada now sends us only about as many cattle as she shipped to us ten years ago, and fewer than she contributed five years back, while the receipts from the United States have fallen off nearly one-half since 1905.

Much interest attaches to the causes of the dwindling of cattle shipments from the United States. The chief cause is the steady absorbtion of the cattle ranges of the West by settlers. It may prove in course of time that a multitude of small breeders and feeders will make good the loss of the ranges as feeding grounds; but hitherto there has not been any approach to such a compensation, and the best authorities in the country are of opinion that it will not be realised for a great number of years. In the meantime the population of beef consumers is increasing rapidly, while beef cattle are decreasing. There were 4,287,000 fewer of these animals at the beginning of 1910 than in 1907.

A secondary cause of the reduction of exports has been the high price of beef in the United States. Again, the high price of maize has led to the slaughter of a great number of calves and half-fat beasts, while the growing importance of the dairy industry makes a great call upon heifers.

Our imports of sheep have become quite insignificant. In 1882 we imported 1,124,391, but there has not been any approach to such a number since 1895, when the total was over a million. By 1909 it had fallen to 8,131. Before our ports were closed to sheep from Argentina, that country had displaced the United States as the chief contributor. At present the latter country and Canada send the few sheep we are receiving, though occasionally we get a small number from Iceland and Greenland.

Meat.

In referring to beef, salt meat may be left out of consideration, as it has long been a dwindling trade, even tinned beef having declined since the Chicago scandals were published, though a partial recovery has taken place since 1907.

What has been said as to the decrease in the imports of cattle from the United States applies also, although in a less marked degree, to receipts of beef from that country. Up to 1904 more than half the fresh beef we imported came from the United States, whereas now it is only about one-fourth, and since 1904 Argentina has been ahead of that country, sending us more than twice as much in 1908. New Zealand has also made a great advance. If the Linley process, by which a large consignment of beef in a chilled, as distinguished

from a frozen condition, was recently conveyed from Australia, proves a success, large increases from that part of the world, as well as from New Zealand may be expected, and these are likely to do more than cover the decrease of shipments from the United States. It is a curious fact that the use of this process has been prohibited both in Argentina and the United States, on what grounds is not clear. But if the process allows of meat being sent from Australia in a chilled state, it will probably be generally adopted. Hitherto Canada has not been a great exporter of dead meat.

Imports of mutton and lamb have continued to increase. New Zealand is the greatest contributor, followed somewhat closely by Argentina. These two countries send three-fourths of our supply, Australia contributing most of the rest, though we get a considerable quantity from the Netherlands, and Chile has been making headway recently.

Pigs' meat of various kinds comes most extensively from the United States, Denmark, and Canada, in the order given. These three countries sent us 7,250,756 cwt. out of a total of 7,753,799 cwt. imported in 1908. Russia, France, Belgium, and the United States supply most of the poultry, and the Netherlands, Russia, and Egypt, most of the game.

EGGS.

Russia is a long way first with eggs, supplying us with nearly twice as many as any other country. Denmark stands next, followed by Germany, Belgium, and France. These five countries make up between two-thirds and three-fourths of the immense total of over eighteen million great hundreds (of 120) that we import in a year. The total had long been increasing almost every year up to 1904, since which date there has been a reduction. The prices paid for imported eggs would not be remunerative to home producers, and it seems impossible that their production in such countries as France and Germany, where corn is dearer than it is in England, can leave any profit upon their sale. The average imported price in 1904 was 1*s*. for over eighteen eggs, and all the expenses of collection and transport, as well as the foreign dealer's profit, have to be deducted. The price has risen since the year named, but no higher than 1*s*. for fifteen to sixteen, and probably less than 1*s*. for twenty is paid to the producers. It may be supposed that they feed their hens chiefly upon tail corn and house scraps, and that they have no idea of the cost of production. Eggs are among the few farm products that have risen rather than fallen in price in this country since the time of agricultural prosperity.

BUTTER.

Our imports of butter, which nearly doubled between 1894 and 1906, when they reached the maximum, have declined slightly, chiefly on account of decreases in shipments from Canada, Australia and the United States. From the country last named they were never very large, and now they have fallen to an insignificant quantity. Denmark is much the most extensive contributor, followed by Russia, France, Sweden, Australia, and New Zealand. Russia (Finland) has made the greatest headway in recent years, while Denmark, with some fluctuations, has greatly increased her consignments in a series of years, those of 1908 representing the maximum. Margarine, which competes with our butter, comes chiefly from the Netherlands. The quantity under its proper name has decreased greatly since 1892; but whether the quantity of adulterated butter, which should be styled margarine, has fallen off or not it is impossible to say. Unfortunately, our latest Act relating to the sale of butter allows adulterated stuff to be sold under other names than that of margarine.

CHEESE.

For a great number of years the bulk of our imported cheese came from the United States. In 1878, for example, nearly three-fourths of the total were derived from that source, and as recently as 1885, or possibly a little later, that country was still the greatest contributor. Canada, however, had then been steadily gaining ground on the strength of superior quality of her cheese and its freedom from the adulteration with extraneous fat which impaired the prestige of her chief rival producer. By 1901 Canada was sending us nearly three times as much cheese as we received from the United States, and in 1908 she sent us about fifteen times as much. Both the Netherlands and New Zealand now supply us with more than twice as much as the United States sends. Indeed, if the figures for the eleven months of 1909 ended with November be taken into account, New Zealand's contribution is six times that of the United States, whence the supply has become quite unimportant. New Zealand has made the greatest advance in the exportation of cheese in recent years, though Canada still sends considerably more than half the total. Australia at one time seemed likely to be a considerable competitor, but has supplied us with only small quantities of cheese occasionally in recent years. Our total imports of cheese have fallen off since 1900.

MILK AND CREAM.

In spite of several efforts to capture our fresh milk market the result is entirely unimportant. The supply of condensed

milk, although large, has not increased since 1900. The Netherlands supplies us with by far the greatest quantity of sweetened condensed whole milk and nearly all the separated milk, France, Norway, Belgium, and Italy being also considerable contributors of the former. Norway stands first with the unsweetened article, followed by France. In recent years milk powder has been imported to an increasing extent, chiefly from Denmark and France. Most of the cream is sent by France, Norway being second in the quantity supplied to this country. The quantity has not at all greatly increased since 1900.

Wool.

It is hardly necessary to state that Australia is by far the greatest exporter of wool to this country. New Zealand stands second, and would be in the top place if the several states of Australia were referred to separately, as the Dominion stands above even New South Wales. South Africa is third in quantity of supplies, and India, in some years, and Argentina, in others, is fourth, followed by Chile and France. Other sources of supply are numerous; but no country, other than those named above, contributes as much as 10,000,000 lb. towards our great quantity of imports. We export nearly half as much wool as we import.

Manures.

Apart from nitrate of soda and guano, most of the manures we import are raw materials for their manufacture. Nearly all the nitrate of soda comes from Chile, though Germany contributes a small quantity; and Peru is the main source of our supply of guano. Of basic slag we import very little, less than 10,000 tons having been received in 1908. Bones for manufacturing arrive from a great many countries, India and Argentina being the only extensive contributors. The greatest shippers of phosphate of lime and rock phosphate to this country are unspecified islands in the Pacific and the United States, followed by Algeria, France, Belgium, and Dutch Colonies. Germany is by far the most important contributor of unspecified manures, and particularly potash.

Implements and Machines.

The classification of our imports of implements, tools, and machines is not as definite as could be desired. Under "implements and tools" there is no distinction between those of the agricultural and other classes; but it may be assumed that the implements are nearly all agricultural, and, as to tools, machine tools are excluded. More than three-fourths, judging from values, which alone are given, are

received from the United States; but there has been a great decrease—about sixty-two per cent.—in imports from that source since 1904, probably because British manufacturers have recently made implements similar in type to those which we receive from the United States. It seems strange that the Netherlands should stand second in this connection, and probably this is in relation to tools rather than implements, and to tools not nearly all agricultural. France, Germany, and Canada follow in the order given, not one of them, however, having sent goods of the value of 20,000*l.* in a year. Canada has made some advance since 1904. The figures relating to agricultural steam engines are too insignificant to be worth notice, the total weight in 1908 being only twenty-six tons. Other agricultural machines come chiefly from the United States, Canada being the only other important contributor. The total value in 1908 was under 726,000*l.*

Future Competition.

There are many reasons for believing that agricultural competition in the future will never again be quite as severe on the whole as it has been in the somewhat recent past. As the land suitable for cultivation becomes more and more occupied, and population increases, the tendency, it seems, must be towards an enhancement of the demand for agricultural commodities relatively to the demand. It is true that there are vast tracts of land in Canada, South America, Australia, South Africa, and the Russian Empire as yet uncultivated; but nearly all of it is distant from a port, and but little of it comparatively is at present served by railways. The cultivation of these great tracts would be profitable with a somewhat high level of prices, but not otherwise. The progress of settlement upon fresh land, except in the United States, has been very slow, because prices have been too low to encourage it. As the population of the world increases, more and more land will be needed to supply it with food, and consumers will be constrained to pay enough to render the cultivation of this additional land profitable.

Possibly some great discovery may add greatly to the productiveness of the soil; but in that case farmers in this country would share in its advantages, so that the severity of competition with them would not become more acute in consequence of the discovery. When it was first found that nitrogenous manure could be derived from the atmosphere, some writers indulged in sanguine predictions as to a vast increase in the productiveness of the land from this tapping of an inexhaustible supply of nitrogen. Possibly some cheap method of obtaining the valuable fertiliser may be discovered

hereafter; but at present the new manure is no cheaper in relation to its efficiency than nitrate of soda or sulphate of ammonia. The point to consider, however, is this: that agricultural competition cannot be made more severe by any discovery, the advantages of which will be shared by farmers all the world over, or, at least, that if there were any difference in the incidence of the advantages, it would be in favour of the comparatively advanced farmers of such countries as our own. Apart from any such fresh means of increasing the yield of a given area of land, both the extension of cultivation and the more general adoption of high farming in new countries would involve a moderately high level of prices, so that neither would render more severe the competition which farmers in old countries have to meet.

To take the case of wheat, it is certain that in recent years the increased production in the world has lagged behind the increased demand, and the result has been a higher level of prices since 1906 than that of the eight years ended at that date. There is some evidence to indicate that the advance is having the effect of stimulating a moderate increase in the world's wheat area; but then this is absolutely necessary to supply the bread-eaters of the world with their principal food. There is every reason to believe that a further advance in prices will be necessary to bring into cultivation the tracts of land, remote from a port, which will be needed for wheat-growing before many years have passed away.

If we turn to live-stock produced to supply meat, it has already been shown in the case of the United States that the closer settlement of the land has reduced the facilities for breeding and rearing cheap cattle and sheep. It is true that more meat could be produced on well-cultivated farms than on ranches, but only at a greater expense; and thus we come again to the argument that a fairly high level of prices will be necessary to keep the supply up to the demands of a growing population.

Although there are countries in South America besides Argentina in which there are great opportunities for the increased production of cattle, it will take many years to level up the native stock to the quality necessary for an important beef trade with Europe, and it is not likely that the progress will more than keep pace with the demand, even allowing for a steady development of the cattle industry in Australia. The undeveloped resources of South Africa in this connection are extensive, but are handicapped at present, not only by the slow progress of improved breeding, but also, and more seriously, by the liability of the herds to be decimated by diseases peculiarly fostered by the climate.

Small farmers in all countries are disposed to keep dairy cattle rather than beef animals, and yet there is no evidence of an excessive supply of dairy produce. Butter and cheese have both sold well for two or three years, and yet our imports have not increased since 1906. Moreover, such additions to our supplies as have taken place have been chiefly those from old countries, while those of the United States have become insignificant, and even Canada has fallen back.

Prospects as to the future of our foreign and colonial supply of mutton are somewhat doubtful. Against the fact that there is scope in Australia and Argentina for a great increase in the number of sheep, there is to set off the consideration that in both these parts of the world the flocks are liable to be decimated by drought. Australian flocks have not yet fully recovered from the enormous losses suffered in a series of droughty seasons, although several years have elapsed since the last of them. Until systematic arrangements have been made for a water supply, without which it is shockingly inhumane to breed large numbers of sheep in dry regions, there will be no certainty of a steady increase in the number. In Argentina, such severe and prolonged droughts as that of 1909 are much less common than they are in Australia, and yet the number of sheep in the country, so far as the doubtful statistics enable us to judge, has decreased by over 7,000,000 since 1895. Sheep have never been much in favour in the United States or Canada, and our imports from both these countries have greatly decreased in recent years, while the supply of mutton from the United States has become insignificant, and Canada does not export it to us. It is also to be noticed that sheep have been reduced in number in nearly all old countries, and that the world's total is much smaller than it was some years ago. The great fall in the prices of sheep and mutton from which our flockmasters suffered in 1909, was due rather to an increase in our own flocks than to imports.

Considerations which apply to the probable future of the trade in mutton apply also to a considerable extent to that of wool, but not fully, because we receive large quantities of wool from some countries where the sheep are not good enough in quality for the export mutton trade. The demand for wool increases so rapidly, however, that there does not seem to be any reason to expect that the supply will ever be excessive for many years at a time.

Prospects as to future prices are perhaps less hopeful for culinary vegetables and fruit than for any other products of the land, but rather on account of excessive home production

than because of any probable increase in imports. The great multiplication of allotments and small holdings has had a marked effect upon the trade in vegetables particularly, as many thousands of families who were at one time buyers, now supply themselves and sell a surplus to their neighbours, or send it to market. With respect to potatoes, the growth of productive varieties, the custom of sprouting the seed tubers, and the improvement in cultivation and manuring have permanently increased the yield from a given area of land; and if, in any season, there is a comparative scarcity, so that prices are fairly good, Germany is always ready to send large quantities to our markets.

In the case of fruit, although growers in countries which have seasons earlier than ours continue to "take the cream off the market," it is chiefly the growing home production which in good crop years brings prices to an unremunerative level. But with fruit and vegetables alike, great benefit to producers might be attained by the re-organisation of our wasteful and unsatisfactory system of distribution, under which middle men obtain more profit in a few hours' trading than growers derive from the labour and expenditure of a year.

WILLIAM E. BEAR.

Magham Down, Hailsham.

THE GLOUCESTER SHOW, 1909.

ALTHOUGH seventy "Royal" Shows have now been held in different parts of the country, yet on only one previous occasion has the city of Gloucester been the place of meeting, and that so long ago as 1853. The Show of that year, in common with all the other Shows of the Society before 1858, resulted in a loss—of 2,084*l*. We are told that "the weather at the opening was so unfavourable—rain falling heavily and incessantly for four and twenty hours, with but little intermission for twelve more—that the Showground was converted into a quagmire. During the night preceding the second day of the Show the yard was coated with sawdust brought from neighbouring saw mills, the footways were planked out, and thus, with improving weather, visitors were able to move about with some degree of comfort."

The Show of 1909 at Gloucester can hardly be said to have fared any better, as far as the weather was concerned, than the meeting of fifty-six years ago.

Some details of the two Gloucester Shows and of the two Shows held in the neighbouring city of Bristol are tabulated below :—

Year	Place of Meeting	President	Implements entered	Entries of live stock	Persons paying for admission	Financial Result (+ = *Profit* — = Loss)
						£
1842	Bristol . .	Mr. Henry Handley, M.P. .	455	510	No record	— 1,806
1853	Gloucester .	Lord Ashburton . . .	1,803	737	36,245	— 2,084
1878	Bristol . .	Col. Kingscote, C.B., M.P. .	6,837	1,354	122,042	+ *1,667*
1909	Gloucester .	Earl of Jersey, G.C.B. . .	4,682	2,980	88,396	— 327

The Showground was situated to the west of the city, about a mile from the stations of both the Great Western and the Midland Railways, on parts of Alney Island, known as Castle Meads, Oxleaze, and Portham. The site, which comprised some 102 acres, was pear-shaped, and was bounded by the River Severn, the sidings of the Great Western Railway, and Over Causeway, the main road from Hereford and Monmouth. The public entrance buildings were erected at the western end of the ground, facing the Severn, and were approached by a foot-bridge over the river, which had been constructed specially for the Show. The entrance for exhibits and goods was in Over Causeway, near the Westgate Bridge.

The usual time for holding the Show was reverted to this year, viz., in the week following the Ascot Race Meeting, the doors being opened to the public at 8 o'clock on the morning of Tuesday, June 22. The judging in the different departments commenced at 9 a.m., and was continued, notwithstanding hailstorms and frequent heavy showers, throughout the day. The Veterinary Examination of the Horses entered for competition in the Breeding Classes was commenced at 6.45 a.m. and concluded by the time settled for starting the judging.

On the Wednesday the Show was visited by His Majesty the King. The special train conveying His Majesty arrived at Gloucester shortly after noon, and at the Guildhall, on the way from the station, Addresses from the City and County were presented to His Majesty. Owing to the main entrance being only approachable over the foot-bridge, a special entrance was provided in Over Causeway, and on arrival at the Showyard the Royal procession was conducted by the Honorary Director through the Stock Yard to the Royal Pavilion, where, after His Majesty had been received by the President (the Earl of Jersey), Lord Moreton presented an Address from the Royal Agricultural College, Cirencester. The King, on re-entering his carriage, proceeded to the Working Dairy, and afterwards inspected a number of prize animals in the sheep and cattle classes. His

Majesty returned at 1.30 p.m. to the Royal Pavilion, where he honoured the President by his presence at luncheon.

Shortly before 3 p.m. His Majesty drove through the Implement Yard to the Horticultural Exhibition, alighting to inspect the exhibits, which were of special excellence. On leaving the horticultural section His Majesty proceeded to the Royal Box in the Grand Stand, where he remained for about half-an-hour, watching the Horse Jumping. Leaving the Showground a little before 4 p.m., a visit was paid by the King to the Cathedral, and the Station was reached about 4.30 p.m., for the return journey to town.

Rain fell during the forenoon of Wednesday, but during the greater part of the time His Majesty was in the Showyard the sun was shining.

In honour of the King's visit, the Mayor of Gloucester (Mr. James Bruton) gave a Banquet in the Guildhall on Wednesday evening, which was attended by the President, Council, and Officials of the Society.

On Thursday the General Meeting of Governors and Members was held in the Large Tent, when cordial votes of thanks were passed to the Mayor and Corporation, the Gloucester Local Committee, and the various Railway Companies, for their exertions to promote the success of the Show. (A full report of the meeting appears at pp. xxiv. to xxviii. of the Appendix.) The weather throughout the day was very showery.

Friday, the first 1*s*. day, was, without doubt, the wettest of all, and, although on the last day, Saturday, the morning was fairly fine, rain fell heavily and continuously from about half-past three in the afternoon until the close of the Show.

The following statements give (1) the number of visitors admitted by payment at different times on each day of the Gloucester Show, and (2) the total daily admissions on each day at the last seven Shows.

(1) *Admissions by Payment at Gloucester*, 1909.

Day of Show	11 a.m.	1 p.m.	3 p.m.	5 p.m.	Day's total
Tuesday (5*s*.)	584	1,102	1,431	1,487	1,492
Wednesday (2*s*. 6*d*.)	7,079	12,898	19,308	19,914	20,019
Thursday (2*s*. 6*d*.)	4,639	11,696	14,531	15,419	15,452
Friday (1*s*.)	11,857	24,721	28,838	30,165	30,281
Saturday (1*s*.)	5,391	12,437	18,184	21,039	21,152
			Total Admissions . .		88,396

(2) *Total daily admissions at Gloucester, 1909, compared with previous six Shows.*

Prices of Admission	Gloucester, 1909.	Newcastle, 1908	Lincoln, 1907	Derby, 1906	Park Royal, 1905	Park Royal, 1904	Park Royal, 1903
Five Shillings	1,492	2,397	1,680	2,752	--	2,011	2,685
Half-crown	20,019	32,142	22,835	25,666	2,770	9,375	12,057
Half-crown	15,452	28,880	22,725	—	7,684	10,912	11,403
One Shilling	30,281	98,489	51,888	46,055	7,754	14,175	20,569
One Shilling	21,152	51,959	33,878	44,670	5,770	16,457	18,299
Totals . .	88,396	213,867	133,006	119,143[1]	23,978[2]	52,930[3]	65,013

[1] Derby, 1906—Only one Half-crown day.
[2] Park Royal, 1905—No Five Shilling day; third day, price of admission (2*s.* 6*d.*) reduced to 1*s.* after 3 p.m.
[3] Park Royal, 1904—Second and third days, price of admission (2*s.* 6*d.*) reduced to 1*s.* after 4 p.m.

The following statements contain particulars of the entries in the several sections at Gloucester in 1909, as compared with the seven previous Shows and the Gloucester Meeting of 1853:—

Entries of Live Stock, Poultry, and Produce.

	Gloucester, 1909	Newcastle, 1908	Lincoln, 1907	Derby, 1906	Park Royal, 1905	Park Royal, 1904	Park Royal, 1903	Carlisle, 1902	Gloucester, 1853
Horses . .	[1]599	[1]664	[1]506	[1]563	[2]372	[2]365	422	521	97
Cattle . .	[1]1,146	[1]948	[1]1,030	[1]926	898	867	944	667	199
Sheep . .	[1]802	[1]695	[1]672	[1]564	591	525	520	545	292
Pigs . .	433	312	368	266	252	227	222	178	149
Total . .	2,980	2,619	2,576	2,319	2,113	1,984	2,108	1,911	737
Poultry . .	754	768	826	811	871	603	763	653	304
Produce . .	765	416	572	525	493	544	609	461	—

[1] Exclusive of Double Entries.
[2] Exclusive of Draught Horses and the Harness Classes.

Shedding in Implement Yard (in feet).

Description of Shedding	Gloucester, 1909	Newcastle, 1908	Lincoln, 1907	Derby, 1906	Park Royal, 1905	Park Royal, 1904	Park Royal, 1903	Carlisle, 1902	Gloucester, 1853
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	
Ordinary . .	7,575	6,490	7,650	7,818	6,590	7,630	9,360	6,693	—
Machinery . .	2,420	2,585	2,165	2,520	1,750	2,060	2,670	2,079	—
Special . . (Seeds, Models, &c.)	2,891	2,960	3,251	2,692	1,629	2,032	2,555	2,321	—
Total . . [Exclusive of open ground space]	12,886	12,035	13,066	13,030	9,969	11,722	14,585	11,093	—
No. of Stands.	437	389	417	424	289	350	456	340	121

The following table gives details as to the prizes offered and the classes and entries of each breed :—

STATEMENT OF PRIZES, CLASSES AND ENTRIES.

HORSES AND CATTLE	Classes	Entries
HORSES :—		
Prizes	—	*£3,003*
Hunter	10	94
Polo Pony	5	36
Cleveland Bay or Coach Horse	2	10
Hackney	9	59
Hackney Pony	4	17
Shetland Pony	2	13
Welsh Pony	2	9
Shire	9	111
Clydesdale	8	38
Suffolk	5	34
Riding Classes	9	98
Harness Classes	12	114
Draught Horse	3	8
Jumping	4	83
Total for HORSES	84	724[1]
CATTLE :—		
Prizes	—	*£2,492*
Shorthorn	16	423
Lincolnshire Red Shorthorn	7	52
Hereford	9	92
Devon	8	50
South Devon	5	30
Longhorn	4	21
Sussex	5	29
Welsh	6	30
Red Poll	5	43
Aberdeen Angus	7	46
Galloway	4	12
Highland	2	—
Ayrshire	2	15
Jersey	7	158
Guernsey	5	44
Kerry	4	40
Dexter	4	58
Milk Yield	12	93
Butter Test	2	45
Total for CATTLE	114	1,281[1]

SHEEP, PIGS, POULTRY, PRODUCE	Classes	Entries
SHEEP :—		
Prizes	—	*£2,015 10s.*
Oxford Down	5	57
Shropshire	10	146
Southdown	6	79
Hampshire Down	9	90
Suffolk	6	32
Dorset Horn	5	26
Ryeland	4	16
Kerry Hill (Wales)	4	24
Lincoln	7	47
Leicester	4	17
Border Leicester	3	15
Wensleydale	3	13
Kent or Romney Marsh	6	79
Cotswold	10	52
Devon	3	15
South Devon	5	37
Dartmoor	3	11
Exmoor	3	22
Cheviot	3	14
Lonk	3	10
Herdwick	2	9
Welsh	2	10
Black-faced Mountain	2	12
Total for SHEEP	108	833[1]
PIGS :—		
Prizes	—	*£710 10s.*
Large White	6	84
Middle White	6	52
Tamworth	6	55
Berkshire	6	120
Large Black	6	84
Lincolnshire Curly-coated	6	38
Total for PIGS	36	433
TOTAL FOR STOCK	422	3,271
POULTRY :—		
Prizes	—	*£212 13s.*
Entries	98	754
PRODUCE :—		
Prizes	—	*£337 5s.*
Entries	64	765

Grand Totals for LIVE STOCK, POULTRY, and PRODUCE. } **584 Classes . 4,790 Entries . £9,924 18s.[2] Prizes**

[1] Animals exhibited in more than one class are here counted as separate entries.
[2] Including £660 for Farm Prizes, £145 for Implements, £229 for Horticultural Exhibition, £120 for Competitions.

Description of Exhibits.

A complete list of the Awards, with full information as to exhibitors, breeders, pedigrees, &c., of the prize-winning animals, will be found in the Appendix to this Volume, preceded by a list of the officials and Judges at the Show (see pp. xxxix. to cxv.). The particulars given in the following pages are, as usual, based mainly on the official reports furnished by the judges. Photographs of all the Champion animals in the Cattle classes are reproduced on this occasion.

Horses.

Though not so strong as at Newcastle, the entries of horses were—with this exception—larger than at any Show since the York Meeting of 1900. There were 599 horses entered in the 84 classes, as against 664 in 95 classes at Newcastle. The Shires had the largest representation with 111 animals entered.

Hunters.—On the whole, these classes were quite fair. The Judges would have liked to have seen more (especially of the better quality), in most of the classes. The winner in Class 3 (three-year-old geldings), was an exceptionally nice horse, and a nice gelding got first prize in Class 2 (two-year-olds). The yearlings were the best in the filly classes, and the Judges were disappointed at not seeing more than four three-year-old fillies. The two classes for brood mares were good, both in numbers and quality.

The *Riding Classes* may be considered fair generally.

Polo and Riding Ponies.—Class 11 (stallions foaled in or before 1906) was, unfortunately, small numerically. The first two were very beautiful animals, and *Spanish Hero*—the winner—although beginning to show signs of age, scored in action and bone. This animal again won the Male Championship. *Othrae*, the second prize animal and Reserve Champion, was full of quality. *White Wings*, third prize, was a nice young horse, and polo bred. There was, however, a sad falling off in the other two competitors. Class 12 (colts, fillies or geldings, foaled in 1908), was a strong class, and they were all so good, that it was difficult to select the best. *Vision*, the winner, was a beautiful and promising colt, and should develop into a champion if he goes on all right. The fillies were smaller and less forward than the colts, and it was difficult to do them justice as compared with colts. In Class 13 (colts, fillies or geldings, foaled in 1907), *Mavonincen*, the first, and *Tith*, the second, showed most quality, although *Flash*, third prize, should make a valuable animal. These three were lovely ponies. Class 14 (fillies or geldings, foaled in 1906) was extremely weak.

Florentine, the winner, was a very nice well-bred filly, good enough to win in a strong class. Class 15 (mares, with foals at foot) was a very strong one, composed of beautiful blood-like mares, with plenty of bone and substance, as well as quality, and looked like playing polo or breeding polo ponies up to weight. *Actress*, the winner, up to great weight, was again Female Champion. *Redstone*, second prize, was full of quality, and was Reserve Champion.

Riding Classes.—In Class 64 (mares or geldings, light weight, foaled in or before 1905) *Flo*, the winner, was a very nice pony, short backed, big and handy, with lovely mouth, and well broken. *Luxury*, second prize, was a beautiful quality mare, but not so handy as the winner. *Dearest*, the third prize, was full of quality, but not so temperate as she might be or up to so much weight. There was a great falling off in the rest of the class. In Class 65 (heavy weight mares or geldings foaled in or before 1905) *Penylam Perfection*, the winner, was a nice, quick, handy pony, up to plenty of weight. *The Nun*, second prize, was a beautiful blood mare to look at, but her shoulders seemed short and loaded. *Gipsy*, the third prize, was a nice strong pony, smaller than the other two, but up to some weight, though with not so much quality as the others.

Cleveland Bays or Coach Horses.—The number of entries was disappointing, especially the class for mares, in which there were but three exhibits. In Class 16, seven stallions came into the ring, all sound horses, and representative of the two breeds. The winner, *Rillington Surprise*, was a horse of fine quality and character, with good free action and likely to develop into a capital sire. The second prize horse, *Aislaby Pride*, was a more powerful horse, but not made on the same lines as the winner. *Aislaby Hero*, placed third, was of nice quality, but requires more time to develop. The winner of the brood mare class, *Madeline*, was a mare of fine quality and action, and had a very good foal. The second prize mare, *Forget-me-not*, was a good mare, big and strong, but rather lacking in quality. *Hawthorn Beauty*, awarded third prize, was a mare of very fine quality, but too light of bone for a blood mare.

Hackneys.—The breeding classes were conspicuous for quality and high merit rather than numbers, nearly all the winners having been to the front at the Spring Show or Olympia, some at both. The London winner, *Copper Plate*, now owned by Senor T. E. de Anchorena, was first in the class for yearling colts. *Albin Wildfire* was first in a moderate class of two-year-old stallions. Three-year-old stallions were quite the best class, the three placed horses being of high

individual merit. *Flash Cadet*, placed first, confirmed his position at the Spring Show and Olympia, and here again added the Championship to his honours list. The great mover, *International*, which was third in London, was here second, and thus changed places with *Kirkburn Masher*, which was third at Gloucester; the latter, a very typical good-limbed stallion, was beaten for action. *International* was Reserve Champion. Sir Walter Gilbey was to the fore in the class for yearling fillies, with *Sprightly Clara*, a home-bred chestnut by "Royal Danegelt," also in the two-year-olds, with the charming daughter of "Mathias" *Spring Bells*, first both at the Spring Show and at Olympia, and which later was placed Reserve for Mare Champion. Mr. R. P. Evans was second with his home-bred *Woodhatch Fragility*. As in stallions, so in the mares, three-year-olds formed the strongest class; here Mr. R. P. Evans' *Beckingham Lady Grace* was first and Champion, a big mare with brilliant action. Sir Walter Gilbey's *Flash Clara* placed second was of a somewhat better type, but not possessing the winner's action. *Medelia* won in brood mares under 15 h. 2 in. for Mr. Evans, moving as well as when winning at the Spring Show and at Olympia this year. Mr. Burnell Tubbs' *Hopwood Clematis* was second, and Dr. Bowie's *Billington Majestic* third. In the larger brood mares, Sir Lees Knowles won with *Knowle Halma*; she looked and moved in excellent form, and her foal was placed second in the next class. Mr. Hinrichsen's *Bright Dorothy*, second, however, produced the first prize foal, a good mover, by "Kirkburn Toreador."

Hackney Ponies.—The entries in these classes were rather small. Nothing in stallions compared with Mr. D. S. Carr's *Little Ruby*; this animal went with all his former dash and brilliancy. *Talke Fire King* was second. *Talke Wildfire* was first in the following class for ponies foaled in 1907, sired by "Fireboy," a bright moving bay with fine action. In three-year-old ponies, Mr. Foster came to the front with *Mel-Valley's Natty*, a charming brown with action. Mr. Lysaght here came second with *Dorothy Iona*, an own sister to *Smite*, second in the two-year-olds, both bred by exhibitor and sired by "Sir Horace." *Julia Snorer* and *The Little Witch* were first and second in brood mares, both being very sweet ponies with good action.

Harness Horses.—These were not, generally, as good as usually seen at the "Royal," and, with the exception of the winners, there were none of special note. Mr. Paul Hoffman was first in the over 15 h. 2 in. single harness class, and was afterwards awarded the Championship. On the other hand, ponies came out in strong force, and in double harness

and tandem wrested the chief honours from much bigger competitors, Mr. Foster's stable being responsible for three firsts in single, a first in pairs under 15 hands, and a second, in same limit, for tandems—a very unique performance. Miss Ross won in Four-in-Hand Teams, and was also awarded the 50*l*. Challenge Cup for best team exhibited, whilst the same owner scored a first in double harness over 15 hands, and was again first in the larger tandem class.

Shetland Ponies.—Class 31 (stallions) was a very good one, the first and second prize winners, *Thoreau* and *Haldor*, being two of the best Shetland Ponies ever exhibited, whilst *Coronet*, third prize, and *Rebel of Earlshall*, reserve, are beautiful ponies of the correct type. Class 32 (mares with foals at foot) was not quite such a good class as the stallions, taken all round, but the first and second prize winners, *Belle of Bressay* and *Corona*, are first-class specimens, with little to choose between them, one remarkable feature being that the first prize winner is sixteen years old, looks and goes like a four-year-old, and was followed by a splendid and well-nourished foal.

Welsh Ponies.—These classes were not large, but included some of the best of the breed, showing the mountain type. The fact that the ponies were required to be exhibited "not docked nor hogged" perhaps prevented a larger entry. The stallion class was won by the well-known *Greylight*, and was followed by the equally well-known *Shooting Star*. *Grove Ballistite* was third, and was somewhat unlucky to have to compete against such exceptionally high-class ponies as those placed above him. The best mare with foal at foot was judged to be *Bleddfa Tell Tale*. This mare has been known at the leading shows for several seasons, and, although getting on in years, found nothing to beat her for type and general character. *Towyvale Myfy* is a pony of very fine quality, and made a good second. *Gwyndy Georgina*, a beautiful little pony, full of quality, and a good mover, was awarded the third prize.

Shires.—These classes were all well filled, and in quality left nothing to be desired. Class 35 contained a lot of good young animals, the winner, *Tandridge Forest King*, is a wonderfully well-grown colt, and must make a valuable sire. The second, *Folville Dray King*, is also a big colt, and moves himself well, and the third, *Bardon Forest Conqueror*, is of grand quality. The Judges do not remember a better lot of two-year-old stallions (Class 36) being shown at the "Royal," *Holker Mars* has so much size and is such a beautiful mover that he was awarded the Championship. The second prize colt, *Mimms Champion*, is also very good, and it seldom

happens that such a good horse has to take a second place. The third, *Pendley Champion*, was last year's winner in the yearling class. He has done well and is quite a good colt. Class 37 (three-year-old stallions) was not so well filled, but the winners were all big massive sires. The first prize was awarded to *Coxford Merlin*, a very short-legged heavy horse, the second to *Marden Jameson*, a horse full of quality and a good mover. The mare and filly classes were all strong in numbers and quality. In Class 38 (yearling fillies) the London winner, *Champion's Choice*, was easily first, and following her were two beautiful quality fillies, both sired by "Lockinge Forest King." Class 39 (two-year-old fillies) was headed by that sweet filly, *Bardon Forest Princess*, and she bid hard for the champion medal, being placed reserve. Class 40 contained two grand young mares, in the first *Barnfields Forest Queen*, and the second, *Marden Peach*, last year's winner. Class 41 (mares with foals at foot) was the biggest class that came before the Judges, *Desford Future Queen* not only won the first prize, but the Championship also. The second prize went to a grand mare, *Pailton Sorais*. The foals were not so good.

Clydesdales.—Considering the distance from the home of the breed, the Clydesdales made quite a creditable show. In the male section the Championship was won by *Dunure Footprint*, a particularly well developed yearling. This colt is well grown, has good limbs which he can use with great gaiety, and was an easy winner. The Championship in the female section was worthily bestowed on *Nerissa*, a three-year-old mare, and one of the best females that has been shown for many years.

Suffolks.—Gloucester is not of easy access from the Eastern Counties, but four out of the five classes were very well filled, both as regards numbers and merit also. The mares and foals did not do justice to the county breed, although they hailed from well-known studs. Class 52 (stallions foaled in 1907) was a capital entry of a dozen, three only being absent. *Easton Trainbearer*, the winner, stood first in his class at the county show at Bury St. Edmunds three weeks before. He is a good specimen of the breed, a handsome colt, has some hard legs and feet, without any prominent fault to keep him out of the first rank. Second to him was *Vanguard*, a pale chestnut, with an immense development of muscle everywhere, but he has faulty hind legs. The Judges took time to come to a decision between him and *Bawdsey Willie*, a nice colt bred by the exhibitor. The choice of the Judges between these two did not coincide with the awards at previous shows. Of the colts foaled in 1906 (Class 53) eight of the nine entries

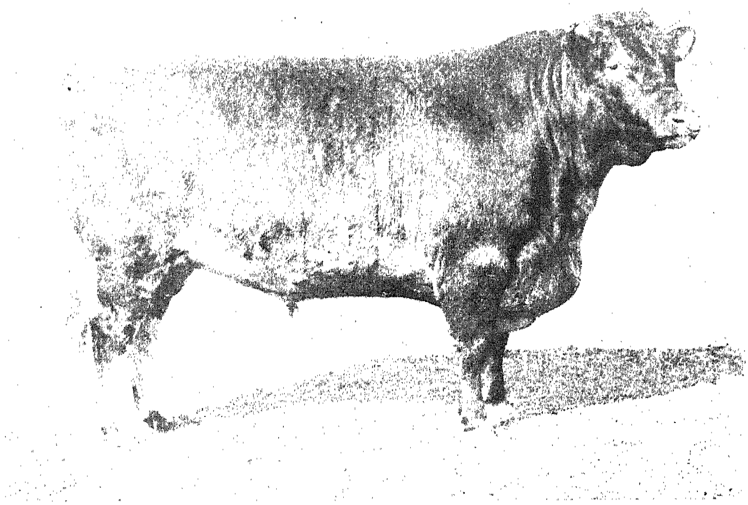

FIG. 1.—SHORTHORN BULL, "DUKE OF HOOLE."
Winner of Champion Prize for best Shorthorn Bull, Gloucester, 1909.
Exhibited by MR. JOHN H. MADEN.

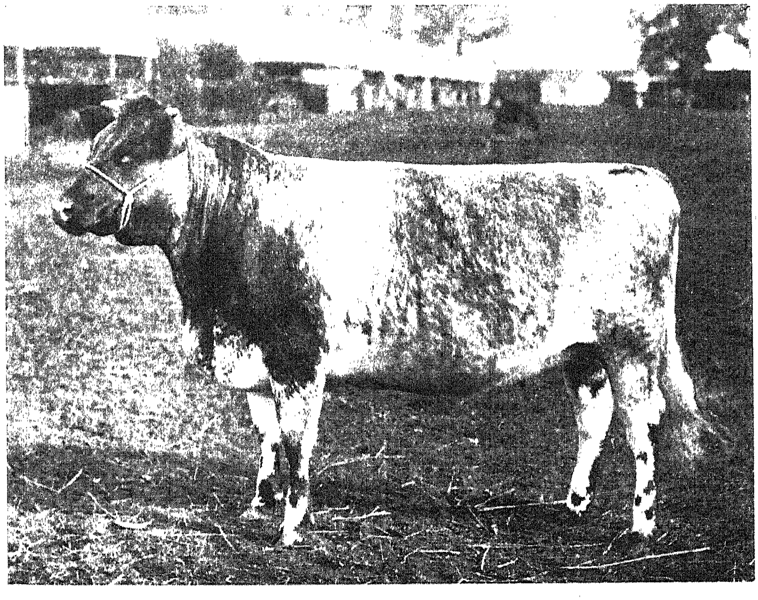

FIG. 2.—SHORTHORN HEIFER, "SHERBORNE FAIRY."

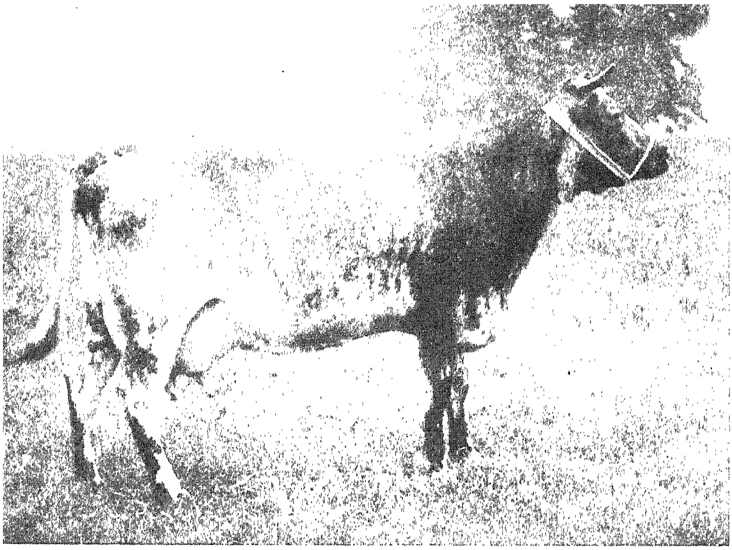

FIG. 3.—SHORTHORN DAIRY COW, "PRIMULA 70TH."
Winner of Champion Prize for best Shorthorn Dairy Cow or Heifer, Gloucester, 1909.
Exhibited by MESSRS. R. W. HOBBS & SONS.

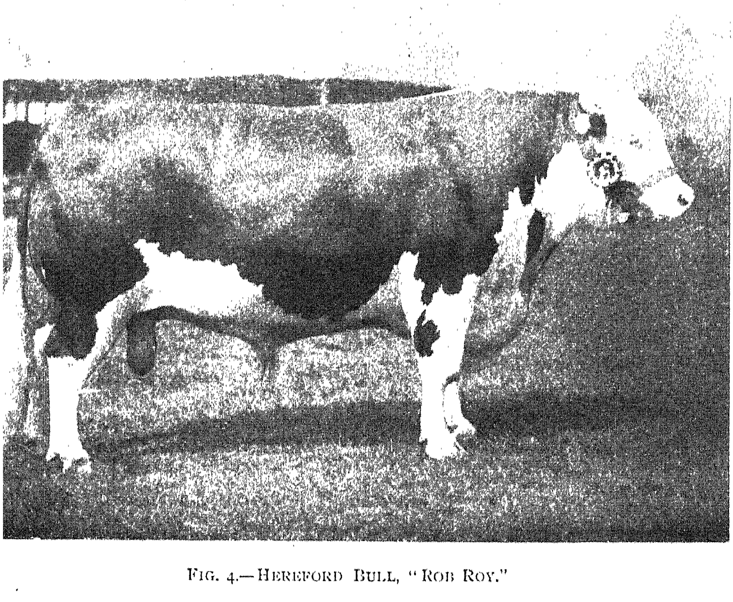

FIG. 4.—HEREFORD BULL, "ROB ROY."

were brought before the Judges. *Easton Duke*, the winner, is own brother to "Easton Trainbearer." The third prize went to Sir Cuthbert Quilter's *Bawdsey Marshal Ney*, a second prize winner at the Bury Show. The two-year-old fillies (Class 54) numbered five. The winner, *Sudbourne Queen of Spades*, is a beautiful mare, ably backed up by *Rendlesham Diabolo* and *Rendlesham Magnet*. *Diabolo* is a remarkably fine square mare upwards, but not quite so good below. Class 55 (three-year-old fillies) was headed by Mr. Carlyle Smith's *Ashmoor Sunflower*, a third prize winner at home. Unfortunately this beautiful true type of Suffolk filly was sadly disfigured by an accidental injury to her knees. *Bawdsey Jewel* and *Sudbourne Lassie* were second and third, both worthy representatives of two famous studs. Class 56 (mares with foals) made a poor show, both in number and merit also; but the danger incurred in sending a mare and foal a railway journey of two hundred miles is likely to keep the names of many breeders out of the catalogue. The Judges were glad to notice a total absence of faulty feet, and if an occasional light bone below the knee detracted from some of the entries, nearly all in the stallion classes showed bone and back sinew enough for any purpose.

Draught Horses.—The horses exhibited in these classes were of excellent quality, but the numerical strength of the entries was disappointing, and one exhibitor gained all the first prizes. The exhibits were judged as products of the agricultural industry from the standpoint of efficiency for subsequent employment in commercial centres.

Cattle.

One hundred and fourteen classes in this section formed the most comprehensive classification ever provided at the Society's Show, and, in all, 1,146 animals were entered. This large number of exhibits has only once been exceeded, viz., at the Windsor Show of 1889. There were no less than 423 Shorthorns, or 51 more than last year, when there was a record entry of the breed.

A novelty in the "Royal" Showyard, were the exhibits of "Old Gloucestershire Cattle" sent—not for competition—by the Duke of Beaufort, Badminton, Sir Lionel Darell, Bart., Frethorne Court, Stonehouse, and Mr. J. Lloyd Baker, of Hardwicke Court (see Note on pp. 415-419).

Shorthorns.—The show of this breed formed the largest and best collection of Shorthorns ever brought together at any meeting of the Society. A considerable number of animals in the classes for males, whose owners had evidently entered them with the sole purpose of qualifying them for the auction

sales, detracted much from the average merit of the classes as they paraded before the Judges and the public. Leaving these out of consideration, the general average quality of the exhibits in almost every class, was decidedly high. The class of old bulls, in numbers and merit, formed one of the best ever seen at any show in the kingdom, and many bulls possessing a high standard of merit left the ring without recognition. The first, second, and third prize bulls, deserve to be specially mentioned. Although differing considerably in type, they were, without question, high-class specimens of the breed. The same remarks apply to the class and winners in the class for bulls calved in 1907, before March 31. Bulls calved in 1907, after March 31, formed a strong class. After the first prize winner was selected the others were somewhat difficult to place. In both classes of bulls calved in 1908 the average merit of the winners was decidedly higher than usual. The group class for bulls was a fairly good one. The Male Championship was awarded to the first prize winner, *Duke of Hoole* (see Fig. 1), in the older class of bulls calved in 1907, the winner in the old bull class being placed reserve number. The female classes, other than that for cows, were very strong in numbers, while the quality all through was exceptionally high. The prize winners in the classes for cows and two-year-old heifers were quite outstanding specimens. The two classes of heifers calved in 1908, were a splendid collection of high-class, promising youngsters, the winner in the older class, *Sherborne Fairy* (see Fig. 2), was awarded the Female Championship of the breed, and the winner in the older class of two-year-old heifers was placed reserve number. The female group formed quite a good and interesting class.

Dairy Shorthorns.—Class 94 was an extra strong one of cows of the right stamp, both for flesh and milk combined. The first prize winner *Primula 70th* (see Fig. 3), also obtained the Championship for the best Shorthorn dairy cow. Class 95 was very even, and the animals exhibited showed good milking properties. Class 96 (heifers in milk), showed great care in catering for the dairy, which must be the chief aim.

Lincolnshire Red Shorthorns.—In Class 98 there was only a poor entry, but it contained two very good bulls, the winner coming up well and showing very gay. Class 99, the two-year-old bulls, were a useful lot of animals, and there was not anything much between the first and second. Class 100 made a strong entry, the first and second bulls being very useful cattle, but two or three of the bulls were overfed and off their feet. Class 101 was a very strong class. The first prize, *Keddington Skipworth 5th*, is a wonderful cow, the second prize cow,

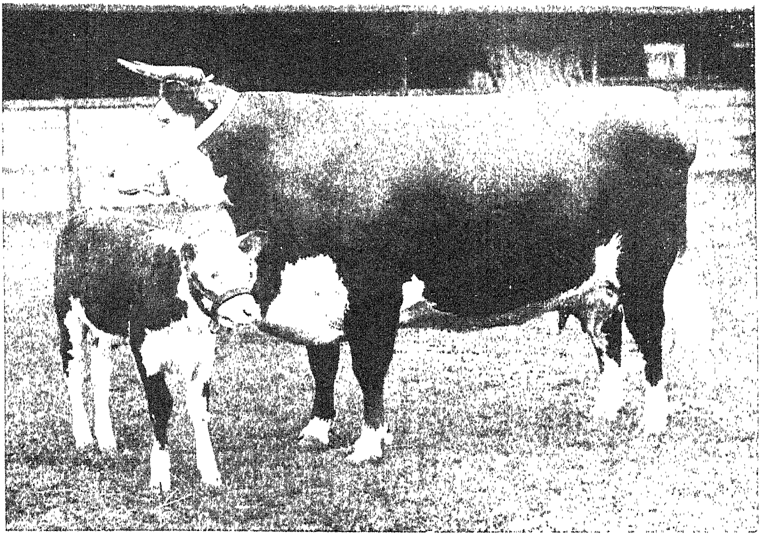

FIG 5.—HEREFORD COW, "MERRIMENT."
Winner of Champion Prize for best Hereford Cow or Heifer, Gloucester, 1909.
Exhibited by THE EARL OF COVENTRY.

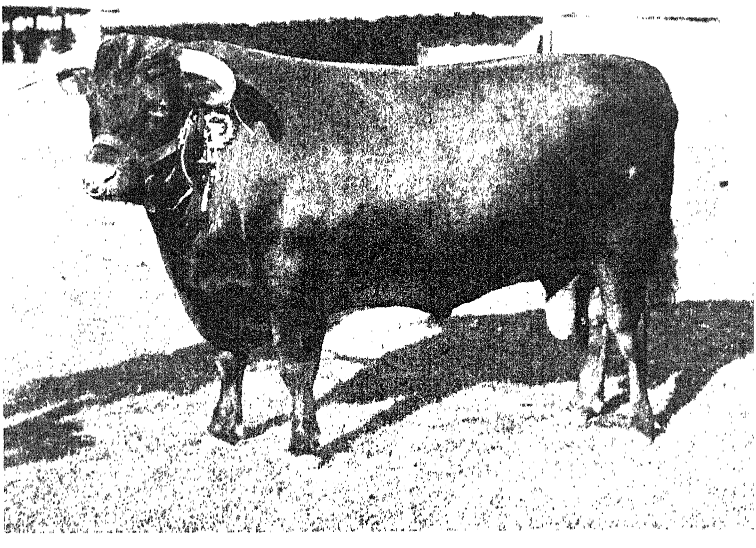

FIG 6.—DEVON BULL, "NORTHMOOR ROYAL."
Winner of Champion Prize for best Devon Bull, Gloucester, 1909.
Exhibited by SIR GILBERT A. H. WILLS, BART.

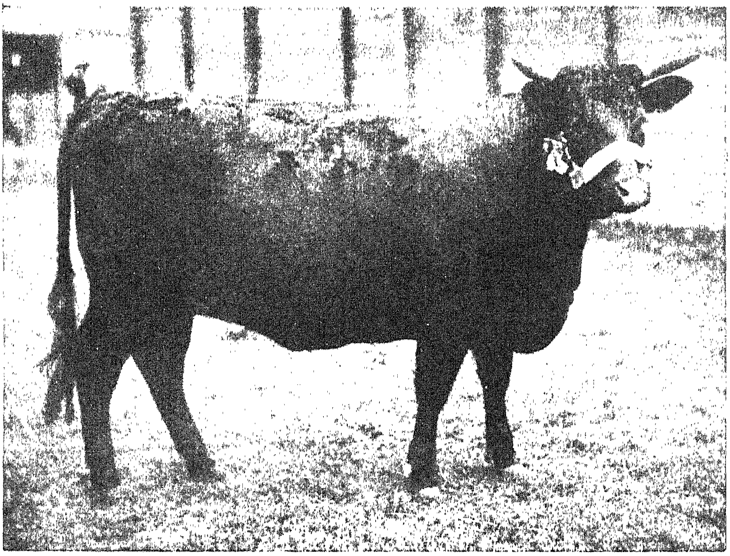

FIG. 7.—DEVON HEIFER "HESTERCOMBE FABLE."
Winner of Champion Prize for best Devon Cow or Heifer, Gloucester, 1909.
Exhibited by THE HON. E. W. B. PORTMAN.

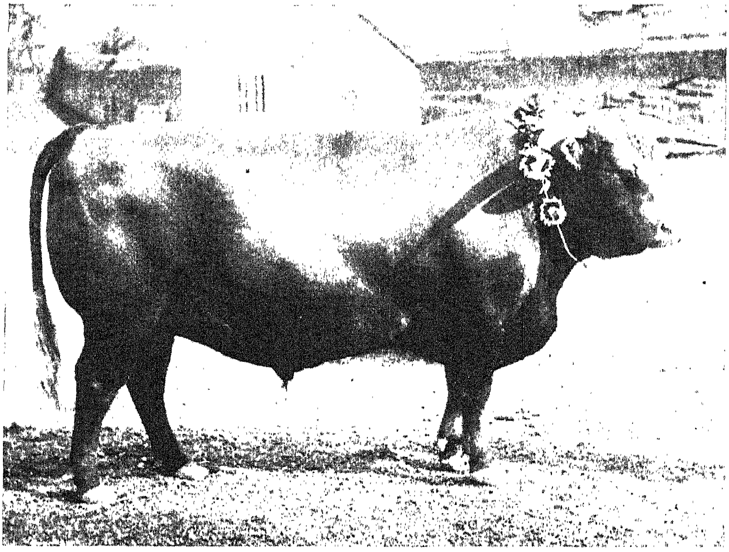

FIG. 8.—SUSSEX BULL, "BIRLING RALPH."
Winner of Champion Prize for best Sussex Bull, Gloucester, 1909.
Exhibited by THE HON. RALPH PELHAM NEVILL.

Benniworth Bloom, coming close up, the third prize cow, *Keal Hilda*, showing very well although having had a pair of calves. In Class 102 there were only two entries, *Pendley Pearl* taking first honours easily. Class 103 (heifers calved in 1907) and Class 104 (heifers calved in 1908) were both strong classes, the latter being the strongest of the breed in the Show.

Herefords. — These cattle being so near their native pastures, well-filled classes was the rule, and, taken as a whole, the breed was excellently represented. In Class 106 *Rob Roy* (see Fig. 4) won easily, and was also awarded the Championship for the best bull. The second was a fair representative of the breed. Class 107 was one of the best classes of Hereford bulls that has been seen for some years, and contained a lot of animals of more than usual merit, all but one being mentioned in the honours list. Class 108 was somewhat uneven, but it contained several very promising bulls. The first and second in Class 109 were really good, and looked like being heard of another day. Class 110 was headed by *Merriment* (see Fig. 5), a very grand cow, subsequently awarded the Female Championship. She was of very noble appearance and majestic carriage, and a fine specimen of the breed. The young heifer classes were well filled. The majority of the exhibits were very creditable to their breeders, and contained some very fine young animals. The family class only produced three entries which were somewhat difficult to judge, but it is satisfactory to know that these were all good.

Devons.—On the whole these were considerably above the average. *Northmoor Royal* (see Fig. 6), the first prize winner in Class 115 (bulls calved in 1904, 1905, and 1906), was also awarded the Championship for the best bull. There were some good bulls in each class. Classes 119 and 120 (cows and heifers) were both good. The yearling heifers (Class 121), undoubtedly came next, supplying the Female Champion in *Hestercombe Fable* (see Fig. 7).

South Devons.—In the class for cows or heifers, in milk, the first prize was awarded to an animal which carried her flesh more evenly than the second, which, however, was a close competitor. In the two-year-old heifer class, the prize-winners were grand specimens of the breed, the class as a whole being a good one. The young heifers might be described as the strongest class, all of which won high praise for their owners, the first and second prizes going to two very fine animals. The old bull class produced three very fine animals, the first prize being awarded to a bull scaling 29 cwt. live weight. The second animal was also much admired. The young bulls were a strong lot, and should prove good stock getters.

Longhorns.—These formed one of the best exhibitions of the breed seen at a "Royal." The cow and heifer class was particularly good. There was very little to choose between the first and second animals, but some of those lower down the class were rather poor in condition. Heifers calved in 1907 or 1908 again brought out some typical and promising animals. Bulls calved in 1904, 1905, 1906, or 1907 were a fine class; the first prize animal was full of character, the second, the youngest bull in the class, ran the winner close, but fell off in point of colour. Bulls calved in 1908 only brought out three exhibits, and the first prize winner was well ahead of the others in the class.

Sussex.—It is to be regretted that in some of the classes larger numbers were not forthcoming, but many excellent animals were exhibited. In Class 137 the Champion cow, *Apsley Fairy* (see Fig. 9), left little to be desired in type and quality. In Class 135 the two-year-old bull, *Birling Ralph* (see Fig. 8), was selected as the Champion because in most respects he represented what should be characteristic of the Sussex breed.

Welsh.—These were a splendid lot, and all the classes were well filled. In Class 143 the first prize cow was a model, compact, with a good bag. Class 144 was very good, the first prize heifer being a very level animal. The second and third were bigger, but not so level, In Class 145 there was keen competition, and they were a splendid lot. The first prize bull in Class 140 will take a very good company to beat him. Only two animals appeared in Class 141, the first was rather small, but of good type and quality. The second was a big weighty bull, short ribbed, rough head with good hind quarters. Class 142 was the best lot of yearlings the Judge had ever seen. The first was a strong, rich animal, with plenty of bone, but lacked a bit in the rump. The second was a nice bull with good countenance, but a little narrow in the hind quarters. The third was close, being stronger than the second, but off his legs.

Red Poll.—This breed was well represented. The old bull class had an outstanding winner in *Warwick* (see Fig. 10), who also took the Championship. The young bull class had also a superior animal which took the first prize. The others were a long way behind. The cow and heifer classes were very good. The cow class had three good animals at the head which showed that they belonged to good milking stock. The two-year-old heifers were the best class of this breed, the winner, *Ashlyns Duchess* (see Fig. 11), also being the Champion. The yearling heifer class had also another outstanding winner, which was reserve for champion, with several useful young heifers following it.

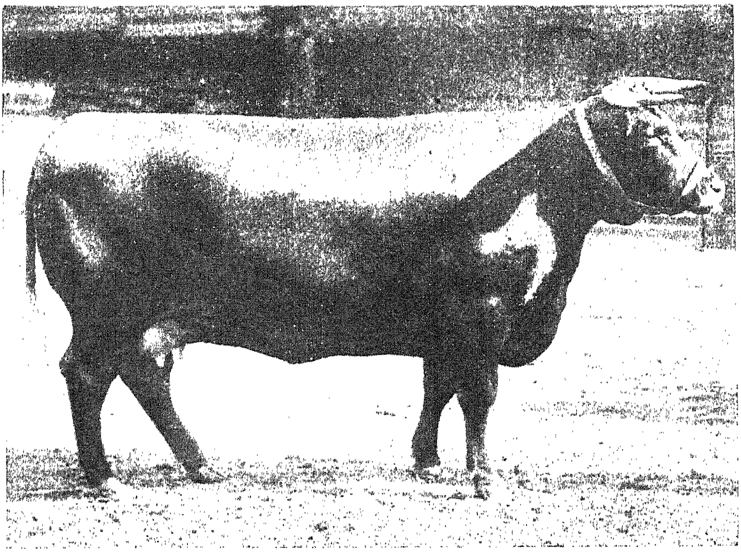

FIG. 9.—SUSSEX COW, "APSLEY FAIRY."
Winner of Champion Prize for best Sussex Cow or Heifer, Gloucester, 1909.
Exhibited by MR. WALTER GEORGE FLADGATE.

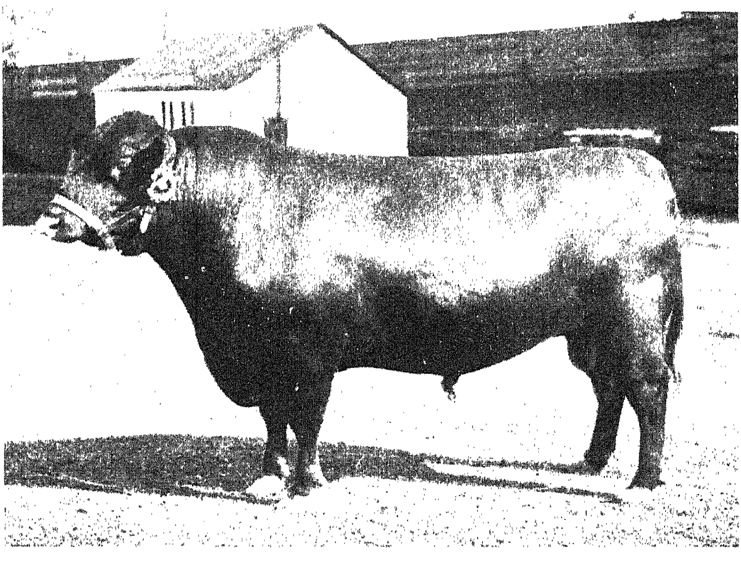

FIG. 10.—RED POLL BULL, "WARWICK."
Winner of Champion Prize for best Red Poll Bull, Gloucester, 1909.
Exhibited by THE MARCHIONESS OF GRAHAM.

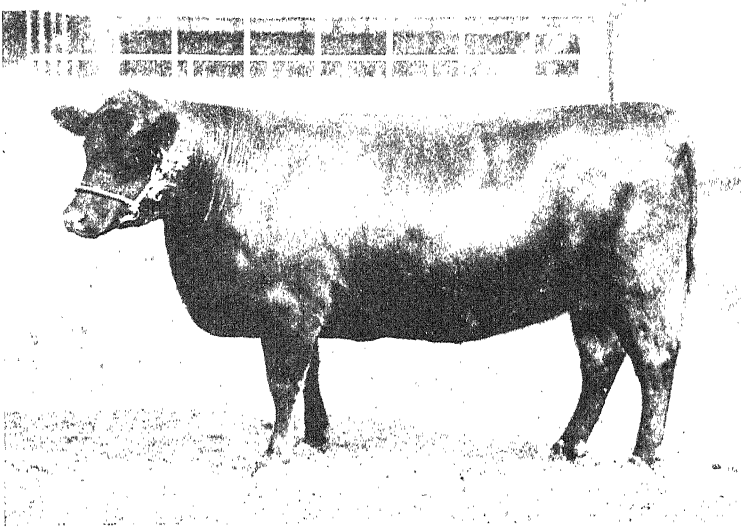

FIG 11.—RED-POLL HEIFER, "ASHLYNS DUCHESS."
Winner of Champion Prize for best Red Poll Cow or Heifer, Gloucester, 1909.
Exhibited by SIR RICHARD P. COOPER, BART.

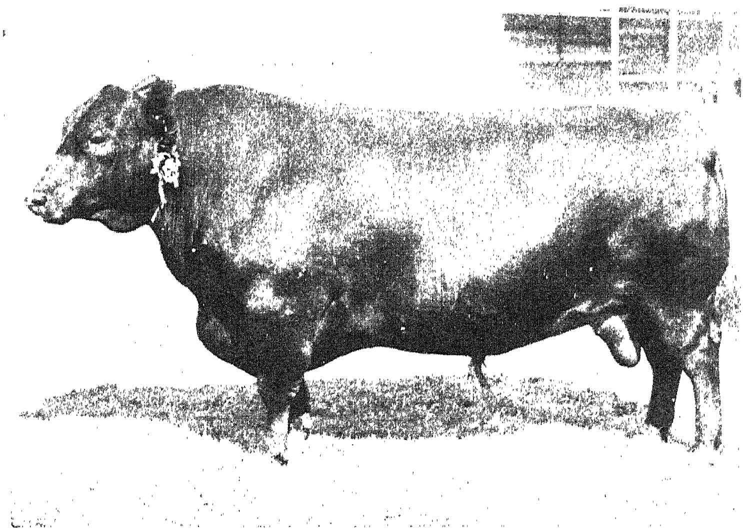

FIG. 12.—ABERDEEN-ANGUS BULL, "EVERWISE."
Winner of Champion Prize for best Aberdeen-Angus Animal, Gloucester, 1909.
Exhibited by MR. JOHN JOSEPH CRIDLAN.

Aberdeen Angus.—These classes were not well represented with regard to numbers. The Champion *Everwise* (see Fig. 12) and the Reserve Champion were both good animals bred in England, the Champion having been bred and exhibited by a well-known breeder within a couple of miles of Gloucester, the Reserve being bred in Northumberland, and exhibited by an Aberdeenshire breeder. *Vellozia of Glamis* (see Fig. 13) won the Gold Medal for the best animal of the opposite sex to the Champion. The leading animals in their several classes were all good, as also were the second and third in a few classes, but the others would take a lot of bringing out.

Galloways.—The entries were small, numerically, but the quality was of high average. In Class 159 only two bulls were shown, and very good animals they were. The first was a very neat, blocky, and well-fleshed animal. The second prize bull was also of very fine quality, but of bigger size and slightly deficient in the thighs. The first prize in Class 160 was given to a very level, gay bull, only 14 months old; the second was an older animal, with not so much gaiety; and the third was a nice bull, shown in lean condition. Three fine cows were shown in Class 161. The first prize animal was very level all over, and shown in fine bloom. The second cow was older and bigger, but not so good behind the shoulder nor in the thighs as the first. The third was a good animal, not so far forward in condition as the others. The first and second animals in Class 162 were very good animals indeed; both were level and sweet. The first was much bigger and heavier than the second, and the third was a nice heifer, rather deficient in shoulder and thigh.

Ayrshires.—These classes, as a whole, were well contested, and contained a lot of very meritorious animals. The cows were a grand lot of well-teated, dairy-looking animals. The bulls were good representatives of the breed, the first prize winner being an animal of most exceptional merit.

Jerseys.—Class 170 contained some very good animals. The five winning cows were as good as could be found anywhere, and were better than have won at the "Royal" for some years. The number of cows noticed following the winners shows the excellence of the class. All the animals in Class 171 received notice, which speaks highly for the quality of the exhibits. Class 172 was a strong one of really nice young cows, the winner again being placed in the first position in Class 174, for the best English-bred Jersey female in the Yard. Class 173 included some very promising youngsters, a number of whom were commended for their high merit. The aged bulls (Class 168) included some first-class sires, generally

showing good quality and constitution. Class 169 was headed by animals of great promise, and eleven others were mentioned, which tells of the strength of the exhibits.

Guernseys.—These classes, which were fairly well filled, produced some animals of great merit, and typical of the breed. In the old bull class *Merton Signet* was placed first. This bull, although five years of age, is still very level and full of quality. The second prize winner, *Hayes Coronation 3rd*, has fine masculine character, and is true to type. The class for yearling bulls produced five entries. The handsome and promising youngster, *Hayes Royal 3rd*, was placed first, and *Merton Golden Noble* second. The cow class contained a very fine lot. *Felois*, an Island-bred cow, was an easy winner, being full of quality, with a beautifully-shaped udder, and great richness of skin. The second prize was awarded to *Mrs. Dreyfus*, a cow with a good bag, nice milk veins, and altogether an animal of good class. The class for heifers calved in 190" orought forth eight exhibits, *Hayes Express 3rd*, a heifer rich in colour and with promising dairy qualities, being placed first. *Lady* 91, another capital heifer, both rich and full of dairy properties, was second. The yearling heifer class numbered ten, the winners being selected from the previous winning herds.

Kerries and Dexters.—In Class 182 (Kerry bulls) there were six exhibits, most of them good animals, the first prize winner and champion, *Bebington Maelcho* (see Fig. 14), being an exceedingly nice one. Class 183 was a splendid collection of Kerry cows, such a fine lot being seldom seen in a show ring. The three prize cows were exceptionally good, with well formed udders. Kerry heifers in Classes 184 and 185 were well shown. Fifty-eight entries in the four classes for Dexters speaks well for the popularity of this breed. Class 187 (bulls) contained many good animals, *Cowbridge General* (see Fig. 15) being a perfect specimen. To Class 188 (cows) the same remark applies as to Class 183. It is doubtful if a better lot of cows were ever shown before. There was little to choose between the three prize animals; they were excellent. The heifers in Classes 189 and 190 as a whole did great credit to the exhibitors, although there was a tendency in some of the animals to coarseness and loss of type.

Sheep.

The entries of sheep—833 in 108 classes—were the largest since the Windsor Show. The Shropshires were most numerous with 115 entries, next came the Hampshire Downs with 90, Southdowns and Kent or Romney Marsh with 79 each, and Oxford Downs with 57.

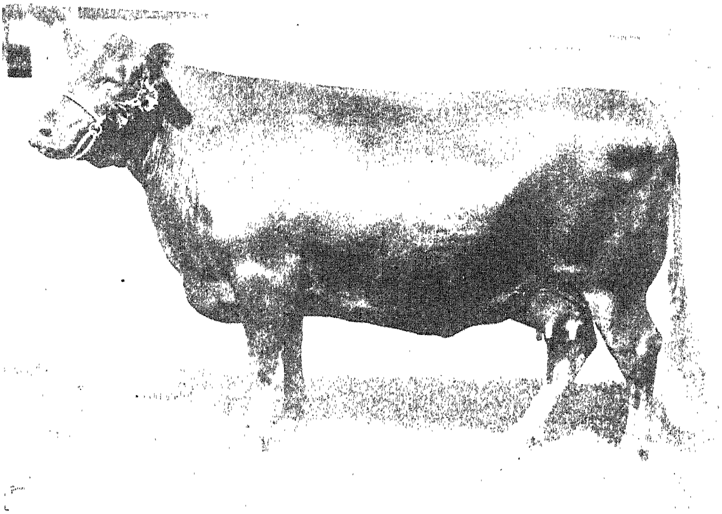

FIG. 13.—ABERDEEN-ANGUS COW, "VELLOZIA OF GLAMIS."
Winner of Champion Prize for best Aberdeen-Angus Cow or Heifer, Gloucester, 1909.
Exhibited by LORD ALLENDALE.

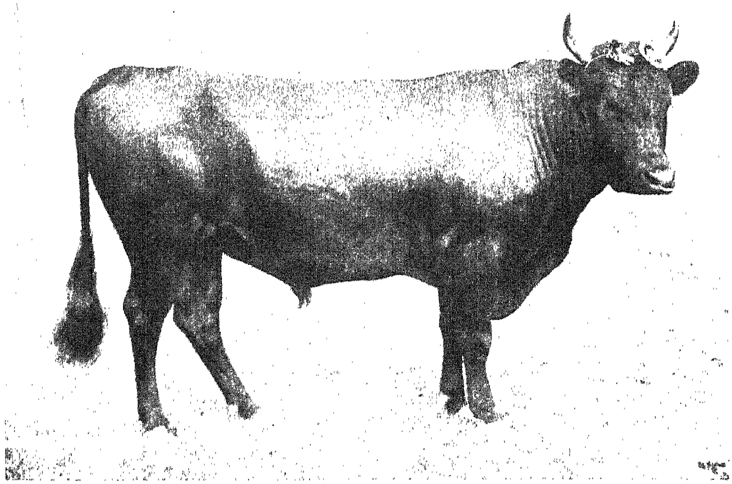

FIG. 14.—KERRY BULL, "BEBINGTON MAELCHO."
Winner of Champion Prize for best Kerry Animal, Gloucester, 1909.
Exhibited by MR. JOHN L. TILLOTSON.

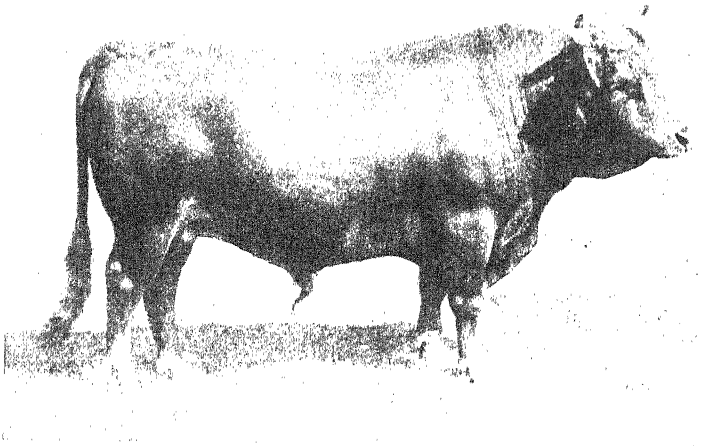

FIG. 15.—DEXTER BULL, "COWBRIDGE GENERAL."
Winner of Champion Prize for best Dexter Animal, Gloucester, 1909.
Exhibited by MR. B. DE BERTODANO.

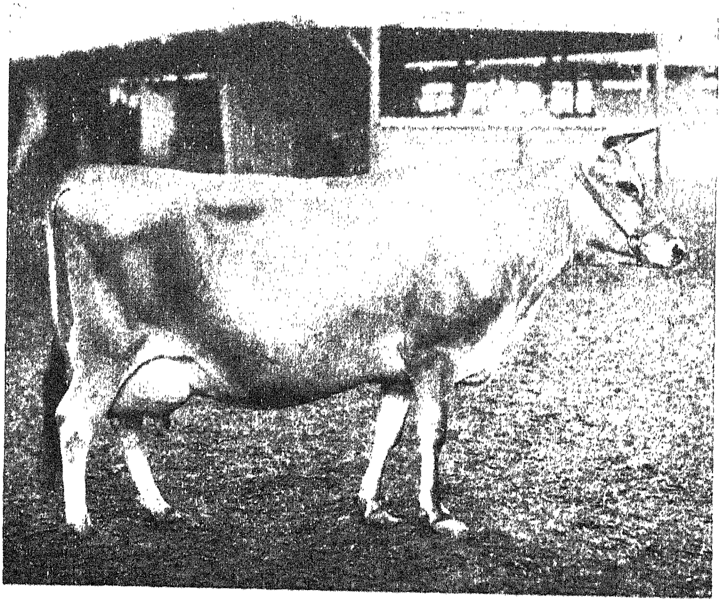

FIG. 16.—JERSEY COW, "LADY PHYLLIS."
Winner of Gold Medal for best Jersey Cow in the Butter Tests, Gloucester, 1909.
Exhibited by LADY DE ROTHSCHILD.

Oxford Downs.—On the whole, these classes were above the average. The shearling ram class contained 13 exhibits of good sheep, headed by a strong, good coloured one of masculine character. His wool was not quite perfect, but otherwise he was an outstanding winner. This sheep also gained the champion prize of the breed. The second prize winner was a sheep of excellent quality both of wool and mutton, and the third was a big useful sheep. The ram lambs showed well, but those in the single lamb class were not equal in merit to those in the pens of three, of which there was an excellent entry, with the whole class commended. The shearling ewe class had seven exhibits, four of which in the order placed were of outstanding merit. The class for three ewe lambs was exceptionally strong, and contained some typically good animals, particularly those of the prize pens.

Shropshires.—Flocks were represented from many counties in England, and from Scotland, Ireland and Wales. Classes 199 and 200 contained many animals of great merit, but to Class 201 (shearling rams) the judges gave the pride of place. Class 205 contained some lambs which should render a good account of themselves next year. The prize-winners in Class 206 were of very high order. The judges were pleased to be able to report favourably on the novice classes generally. Class 208 (ten shearling field ewes) contained three pens which for general excellence would be hard to beat.

Southdowns.—Class 209 (old rams), brought out 16 exhibits, a sheep from the Babraham flock carrying off the first prize and the Champion Gold Medal for the best ram in Classes 209 and 210. This was a grand sheep, full of quality, and the real type of a Southdown. The second prize also went to a sheep from the same flock. There were other useful sheep, and in all, it was a good class. Class 210 (shearling rams), contained several good sheep, the first prize going to the Crockfords Hall flock, for a very good sheep with good flesh and quality. He was also Reserve Champion. The second prize went to a sheep from the Cockfield Hall flock, a good type of Southdown. The third prize winner, from the Babraham flock, was also a good sheep. Class 211 (three shearling rams), though not so well filled (8 entries) contained some good sheep, the first and second prizes going to the Babraham flock. They were first class type of Southdowns. The Crockfords Hall flock supplied the third pen, containing useful sheep. Class 212 (ram lambs), contained some very good sheep, the first prize going to a pen from the Cockfield Hall flock, a good pen of lambs with good heads, good fleeces, and good character. These were followed by a pen from the Carlton Grange flock, not quite so good in the heads as the

first pen. The third prize pen, from the Sandringham flock, was also a nice one, but these were not so even as the others. There were other good lambs in the class, but the pens did not match. Class 213 (shearling ewes), brought out 7 entries. The Judges did not think this class quite so good as usual. The first prize went to a grand pen of ewes from the Sandringham flock. They were very easy winners, and carried off the Champion Silver Medal for the best pen of ewes or ewe lambs. Class 214 (ewe lambs) was another very good class, well filled. Here again, the Sandringham flock carried off the first and second prizes with good pens of lambs, the first being also Reserve Champion. The third prize went to the Crockfords Hall flock, also a good pen, but not quite so even as the others.

Hampshire Downs —The Judges state in their report that "undoubtedly, the show of Hampshire Down sheep at Gloucester will rank as one of the best ever seen, both in numbers of entries (90 pens), and the quality being remarkably good in every entry. Every class was well filled and the competition very keen throughout, which speaks well for the increasing popularity of the breed." The introduction of the Novice Class was very popular, and was successful as regards both merit and numbers of entries, and many of the pens would have got well to the fore in the open class.

Suffolks.—The entries were not numerous, but there were several good specimens of the breed. The first prize pen of three ram lambs contained a very fine lamb, well made in every respect and a good handler. There were only two pens of three shearling ewes, and the second pen were very big sheep, but lacked type and quality. The leading pens of ewe lambs were very smart, had good colour and true breed type.

Dorset Horns.—This breed made a very good and representative show as a whole, all the classes, except that for ewes in the wool, being well filled. The other weak class was, perhaps, that for shearling rams, but even in this there were some very useful specimens; all the other sections were of high quality.

Ryelands.—The Judge reports "The exhibition of Ryelands is about as good as I have seen for some years." In Class 235 (rams, two-shear and upwards) the merit was all that could be desired. The first prize sheep was a very massive stylish ram, with a wonderful wide straight back, good coat, and legs well set apart, but that could be a bit more masculine, and should possess a little more bone for a sheep of his scale. The shearling rams (Class 236) were extremely good. The first prize went to a sheep with which very little fault could be

found, possessing a good head, legs well set outside, and plenty of scale, but which could have a thicker fleece. The ram lambs (Class 237) included some very promising youngsters. The first prize pen were of nice type, with plenty of length and spread and close to the ground. The second pen were a stylish lot and evenly matched, but inclined to grow a bit too high on the leg, and perhaps a trifle long in the ears. There were also some very nice lambs in the third pen. Class 238 (shearling ewes) was of high standard. The first prize pen showed good type, had good fleeces, and were evenly matched. There was not much to choose between the second and third prize pens, there being one ewe in each lot not equal to her partners.

Kerry Hill (Wales).—The first prize winner in Class 239 (rams, two-shear and upwards) was an exceedingly nice sheep, typical of the breed, though not without faults. The second was a big sheep with good wool and bone, strong back and loin, but his marking is not quite right. In Class 240 (shearling rams) the first prize went to a big sheep with good bone and markings, but his wool was not quite dense enough. He drooped in his hind quarters somewhat, and was rather narrow in his shoulder top. The second should grow into a useful sheep. The third was rather smaller than the others, and the class as a whole was disappointing. Class 241 (shearling ewes) was the most uniform and best class of the breed. The first prize winners were a good level pen with nice character, and were run very close by the second prize pen. Class 242 (ewe lambs) was not a good class, the first were a nice pen of young lambs, good in their shoulder and fleece, but rather backward in condition. The second pen had better markings than the first, but were rather soft in their fleece. The third prize winners were light in the fleece.

Lincolns.—The two-shear rams (Class 243) were a fine lot of animals, good in quality of wool. Class 244 (shearling rams) contained some very even well-grown sheep, the first prize winner, a grand upstanding animal, well sprung in ribs and good in mutton, with a very fine quality of wool, being also awarded the Male Championship. Class 245 (five shearling rams) was one of the best pens of shearling rams shown at the "Royal," the first, second, and third were very good in quality of wool. In Class 246 (three ram lambs) the animals were not quite so well grown as in other years, and they were rather light in the fleece. Class 247 (three shearling ewes) were a good even lot, well sprung in ribs and with heavy fleeces. In Class 248 (three ewe lambs) the exhibits were a little under size, and the fleeces were rather light in staple. Class 249 (three shearling ewes, in wool) were the best class of the breed

shown, being great in size, and having very good quality of wool, with great length.

Leicesters.—The shearling rams (Class 250) were a very good class, as also were the shearling ewes (Class 252). Some very good ram lambs and ewe lambs were exhibited, the latter causing the Judges great difficulty in making the awards.

Border Leicesters.—The first in Class 254 (rams, two-shear and upwards) was a characteristic specimen of the breed, with good mutton points and a good coat. The second was a lengthy framed, good type of sheep. In the shearling rams (Class 255) the first prize winner was a strong, well coated sheep of good breed characteristics. The second was an active sheep, with good coat and lengthy frame. Class 256 (shearling ewes) was perhaps the best of the breed at the Show, the first and second prize animals being strong uniform sheep of good type. The third was also a good specimen, but weaker in the head than the winner. The Challenge Cup for the best animal was awarded to the Right Hon. A. J. Balfour, M.P., for his first prize winner in Class 254.

Wensleydales.—These classes were up to standard as regards quality and type. In the matured ram class, the winner was of high merit, with good head and fleece, and stood well on his legs. The second was a nice type of ram, but not brought out in as good show form as the winner. In the shearling ram class, the first was a clear winner, beating the second in scale and masculine character. The other entries in this class were very good specimens of the breed. The shearling ewe class was nothing exceptional in point of quality, the winners were an even matched pen, full of quality and style, and the second prize pen were well matched, but lacking a little in their fleeces.

Kent or Romney Marsh.—This breed continues to make progress, and competition becomes keener every year. Class 260 (two-shear rams) contained nothing very remarkable. Class 261 (shearling rams) was a very strong lot of good typical sheep, the first prize animal taking the Championship of the breed. The new class for pens of five shearling rams (Class 262) proved a decided success, and no other class so plainly showed the great improvement in the similarity of type of this breed, the two first pens being probably the best matched lots ever shown. The ram lambs (Class 263) were a good lot, many of them being promising specimens. The shearling ewes and ewe lambs were also good and typical of the breed.

Cotswolds.—The fact of the Show being in the district of these sheep, and the action of the Cotswold Sheep Society in providing a considerable sum of money towards the prizes,

induced the R.A.S.E. Council to provide no less than ten classes for the breed, and there is every indication that this action was duly appreciated by the breeders seeing the number of entries they made. The shearling ewes (novice) were very strong, and the prize winners in the class for ewe lambs were the best the Judges had seen for years.

Devon Longwools.—Class 276 was an uneven lot of rams, but the first and second prize winners were big specimens of the breed. The first in Class 277 (shearling rams) was a grand sheep and a very good type of the breed. The second was rather of South Devon character. The third was of very good quality, but hardly big enough. All the entries in Class 278 (three shearling ewes) were very good.

South Devons.—The two-shear ram class did not attract a large number of exhibitors, but the individual exhibits were good. The shearling ram class brought out a great many exhibits, twenty coming before the Judges, a large number of the sheep shown being typical of the breed. The Judges were pleased to note that the wool of most was of uniform quality, but still further improvements might be made in this direction. The winning pen of ram lambs was of exceptional merit, being big with plenty of wool of good quality.

Dartmoors.—The class for rams, two-shear and upwards, produced only three entries, but they were all of exceptional merit. The Judges considered the winning sheep in this class a good specimen of the breed, being big with wool of very good quality. The shearling ram class contained some animals which were typical representatives of this popular breed, but in the opinion of the Judges the ears of some of the exhibits were too long.

Exmoors.—These were an exceptionally grand lot. Never have there been so many entries (which totalled twenty-two) or sheep possessing so much merit in the history of the breed. The old ram class was much admired, although the exhibits numbered only five. The shearling ram class was well filled, and contained some fine specimens which were a credit to the breed, possessing plenty of good wool and being full of flesh. The shearling ewes were a good class, typical, and of excellent quality.

Cheviots.—These, as a whole, were very good, especially the old sheep and the shearling ewe classes. The shearling rams were not quite so good as usual, but the Show being held so far away from the home of the breed, the number of exhibits was very small.

Lonks.—The Judge was pleased to see an improvement in the Lonk classes. The first prize winners were well up to standard.

Herdwicks.—The first prize winners in the ram class and the shearling ewes class were very good sheep.

Welsh Mountain.—Four flocks were represented by ten entries. The sheep exhibited showed that good progress is being made in the efforts to improve the breed, and to secure uniformity of type. The first prize winners in both the classes were of excellent quality and true to type.

Black-faced Mountain.—The rams were very good, especially the three-year-old that took the first prize, a sheep with capital bone and colour, a good coat, and a great deal of style. The shearling which was placed second was also a very nice stylish sheep. The third prize winner, an aged ram, was very good, though his coat was getting a little deficient owing to age. The shearling ewes made a small class of very nice, well-bred sheep, able to hold their own at any show. The first and second prize winners were particularly good.

PIGS.

The number of classes, thirty-six, in this section, was the same as last year, but the entries, totalling 433, broke all records, being 65 more than at Lincoln in 1907, when the previous largest entry of pigs was made.

Large Whites.—The total entries in the six classes allotted to these animals numbered eighty-four, and of these only four were absent. The type throughout was exceptionally good, and the finest representatives of the breed were on exhibition. There were twelve entries in the class for old boars; the first prize winner was a nicely shaped pig of good breeding; the second and third were also good specimens. Yearling boars were very strong, being represented by eleven entries. The first was a typical Large White, one of the best seen for some years; this boar was also the winner of the Champion Gold Medal for the best animal in Classes 302 to 306. The second prize winner was a well-grown pig, and the third prize animal was a very good type. Class 304 (boars farrowed in 1909) was a strong class comprising twenty-seven entries, and contained some very useful animals. The first prize winner was a pig of great length and scale. The second prize, although carrying more flesh, had not the scale and character of the winner. A very forward and promising pig was third. Class 305 (old sows) contained but nine entries, each exhibit receiving honours. The first was a well-made sow, of very great size, and even in her flesh. She was eventually placed Reserve for the Champion Gold Medal. *Model of Worsley* followed closely and was awarded second prize. The third prize sow was a remarkably well and very heavy-fleshed pig. Class 306

(sows farrowed in 1908) contained fifteen entries, an exceptionally fine lot of pigs, the first honours going to a nice level sow by "Turk of Spalding," the second going to a good deep well-fleshed sow, the third to a nicely built and very straight pig. In the Class No. 307 (pens of three sows farrowed 1909) there were thirty nice typical animals. The first pen, all by "Emperor of Worsley," were well grown and nicely matched. The second pen, by the same sire, were a nice even pen, and the third were of a well-shaped type.

Middle Whites.—The exhibits in this section were the best and most uniform of recent years. The class for old boars, over eighteen months old, brought out two remarkably good pigs, the winner scoring with very little in hand. The boars under eighteen months were not so good, but the first prize winner should make a good stud boar. Thirteen boars under six months came before the Judge, but, unfortunately, some very good young pigs were spoilt through being overfed and off their legs. The older sow class had six exhibits, all of them good. The first prize was won by a three-and-half-year-old sow with great size, combined with excellent type and quality. The second was a younger sow, showing nice breed character. The class for sows under eighteen months was the best in the section, and contained nine exhibits, any one of which would win in an average class. The first prize winner was of beautiful type, and well shown. The second sow was three months younger, but very level and well fleshed. The third was a bigger sow, but hardly so true. The ten pens of three young sows contained some excellent young animals, but here again several were overdone. The winning pens were very well matched and true to type. The first prize old boar won the Medal for Champion pig in the section, the second in the same class being reserve.

Tamworths.—Class 314 consisted of five very good boars, very uniform and true to breed, the first prize winner, *Astley Abbott*, being also awarded the Reserve Championship. Class 315 was a very strong class of beautiful pigs. There was a large entry in Class 316, and three animals were commended in addition to the prize winners. Class 317 was a splendid lot of matured sows, the three prize winners being exceptionally good. *Constance*, the first, also secured the Championship. Class 318 was very large for the breed, and included some beautiful young sows. In Class 319 there were twenty-four very nice youngsters, wonderfully well grown for their age.

Berkshires.—These classes, the Judge states in his report, were the best seen for quite fifteen years. With the exception of a few moderate pens of three of this year's

sows, all the classes were of more than usual merit. In addition to the prize animals, many of the exhibits received commendation. The winner in Class 320, *Don Camphor*, also won the Championship.

Large Black.—Taken as a whole, these were excellent, both as to merit and number. Class 326 (old boars) was headed by a grand boar, which was also Champion. Standing its age well, this animal was very fleshy and deep in sides, and had well-filled hams. The second, also Reserve Champion, was rather coarse in the shoulders and sides. Class 327 (boars farrowed in 1908) contained some very good young boars, the winner, full of quality, having excellent shoulders and nice hair. The second was of good quality, but a little coarse in the shoulders. Class 328 (young boars) contained an excellent lot of pigs full of promise. The winner was very fleshy and of masculine character, with hair having a tendency to be bristly, and with ears well placed on. The second was full of quality, very long and deep in sides, but not sprung enough in the rib. Class 329 (old sows), which included some grand specimens, was headed by a level sow, full of quality, with nice hair, wonderfully deep in sides and level all through, with hams well filled right down to the hock. This sow was awarded the Breed Society's Challenge Cup. Class 330 was an exceptional class of young sows, the leaders being very close in merit. The first prize was awarded to a well-grown, lengthy sow, very deep in side, with good top and underline, level, well-filled hams, good face and ears, but short of hair. In Class 331 (three 1909 sows) the first prize was awarded to a very large and well-matched pen. Some of the pens in this class were not well matched, and were weak in the legs.

Lincolnshire Curly-coated.—This breed was well represented, and some very typical animals were entered in each class. In Class 332 the first prize boar was exceptionally fine, well on his feet, showing great size and good quality. This boar was Male Champion. The class generally showed pigs of quality and well fleshed. Class 333 contained some good animals, the first prize winner being a useful pig well up on his legs, long back, and typical of his breed ; as also were the entries in Class 334. Class 335 was smaller, but the quality was good, the first—a sow farrowed in 1906—being an excellent specimen. This animal was afterwards awarded the Champion Prize for the best sow. Class 336 was well filled with good sows, but the one placed first was well ahead of the others. In Class 337 all the pigs entered were well fleshed. Generally speaking, blue spots were not so conspicuous, and improvement all round was noticed.

Poultry, including Ducks, Geese, and Turkeys.

Three judges were again appointed in this section to award the prizes, amounting to 212*l.* 13*s.*, and there were 754 entries in the 98 classes. Mr. H. Abbot judged the Game Fowls, Dorkings, French, Ducks, Geese, and Turkeys; Mr. W. H. Cook the Langshans, Plymouth Rocks, Minorcas, Sussex, Brahmas, Cochins, Campines, and Table Fowls: and Col. S. Sandbach the Wyandottes, Orpingtons, and Leghorns.

The *Game* classes, Mr. Abbot reports, were fairly representative, and some very good birds of their respective varieties were penned. *Dorkings* were also fairly good in quality, but few in numbers. *French* were good and well represented; while Ducks, Geese, and Turkeys were few in number and of only moderate quality after a few individual birds had been picked out. Undoubtedly the winning *Old English Game* cock deserved his position as best bird in the Show, while the winning *Sumatra Game*, *Geese*, and *Turkeys* were excellent specimens. Mr. Cook reports that the section judged by him excelled in quality, and many of the classes were well filled. The classes for *Sussex*, *Rocks*, *Campines*, and *Langshans* came up in entries remarkably well, and contained most of England's best and leading winners. Col. Sandbach reports that the *Orpingtons*, some 200 in number, were the outstanding feature of the Show, the whites being the finest. Buffs were numerically the strongest, and quality was conspicuous. In the old cock class competition was keen, and there was not a bad bird in the class. Hens were fair. Pullets were promising, but not so forward as the cockerels. The black class contained some noted winners. The classification for *Wyandottes* was generous, and there was a good response. Partridge cocks were the best, and the birds were in good feather and well shown, though they had not attained the perfection in top colour and striping of the Partridge Cochin. The cockerels were large and wonderfully grown for their age. Whites were more numerous and almost as good in quality. Gold and Silver Laced were few but good. *Leghorns* were disappointing in numbers, most of the large breeders being absent.

Produce.

Butter.—In Class 436 the entries were few in number and the quality of the produce not very good, in fact, two or three exhibits were bitter in flavour and in only one case was the packing of the butter suitable for commercial purposes. Classes 437 and 439, for butter with and without salt respectively, made from the milk of Channel Island or South Devon cattle and their crosses, were of a high order of merit. It

is necessary, however, to draw attention to the fact that several exhibitors had butter present in classes in which it was not entitled to be. Both in Classes 438 and 440 butter was shown identical in every respect with that entered in Classes 437 and 439. Classes 437 and 439 were for butter from the milk of Channel Island and South Devon cattle and their crosses, whereas Classes 438 and 440 were for butter made from milk of cattle of any breed or cross *other than* the Channel Island and South Devon cattle and their crosses. Obviously those who entered butter of exactly the same quality under the two different conditions did so at a disadvantage to themselves, if not to other exhibitors, as in all fairness to other exhibitors their entries in one of the classes had to be disqualified. Class 441 for 2 lb. of butter made up in plain pounds from scalded cream, attracted a good many entries, and the prize winning exhibits were of most excellent quality. In Class 442 for 3 lb. of fresh butter slightly salted, made up in pounds in the most attractive marketable designs, many of the designs were of a highly elaborate character—made in some cases at the expense of the butter, when a more simple imprint would have left it of better shape and appearance. In Class 443 for 3 lb. of butter, fresh, slightly salted, made up in pounds and packed in non-returnable boxes for transmission by rail or parcel post, several exhibitors evidently had very little idea of a practical means of packing butter for market. In a few instances, however, the packing was all that could be desired, though in one or two cases where the packing was good the butter was of inferior quality, and so the advantage of good packing was lost.

Cheese.—The quality of the Cheddars was on the whole satisfactory. A few of the exhibits were sweet made and tough, and in consequence the quality and flavour were faulty. The prize lots were quite outstanding in flavour and texture, and showed all the features of prime Cheddar cheese. The Cheddar truckles were somewhat irregular in quality and flavour, and a number of the samples were found open in texture. The quality of the *coloured* Cheshire cheese, with the exception of the prize lots, were rather disappointing. Several of the exhibits were rather tight made, and showed over acidity with dull cloudy colour. The Judge (Prof. Drummond) remarks that Cheshire makers might, with advantage, use a ripening agent in the milk, prepared from a pure culture. The prize lots were excellent samples, being clean in flavour, bright in colour, with a creamy texture. Cheshire cheese, *uncoloured*, was a useful class, but nothing of outstanding merit was found, faulty flavour and over acidity being the principal objections. There was a good display of Stiltons, all

well made and of good quality, which would develop on maturity. Double and single Gloucesters were well represented. The texture and flavour of these makes were both good and of uniform quality, so that great care had to be exercised in awarding the honours.

Cider and Perry.—The Judges, in presenting their report of what, in their opinion, was without doubt the world's record show of Cider, state that the exhibits as a whole showed a vast improvement in quality and get up, and that there was a general advancement as regards purity. There were, however, still too many exceptions, and these gave the Judges the greatest difficulty. Saccharine had undoubtedly been used to sweeten some exhibits, while in others the analysis showed the presence of preservatives. As the latter did not comply with the conditions, they were disqualified. In Class 454 (Casks of Dry Cider) many exhibitors sent sweet or very acid cider, but the prize samples were very nice. Class 455 (Casks of Sweet Cider) was a large one of good ciders. Here some mistakes were made in not allowing the cider to ferment sufficiently. Owing to the constant shifting, secondary fermentation had been set up in several exhibits. Class 456 was very poor both as to entries and quality. Class 457 (Dry Cider, bottled) contained some excellent ciders, a few were rather too acid, and some sweets were obviously in the wrong class. Class 458 (Sweet Cider, bottled) as a whole was very fine, most of these ciders being clean and well made. Class 459 was fairly good, with a superb first prize lot, exhibited by Messrs. Tilley, to whom the Champion Cup was awarded. The prize and commended exhibits were all of fine quality. Class 460 was decidedly indifferent, a most unusual case in a dry perry class. Class 461 (Sweet Perry) was very fine indeed. Some exhibitors had, however, sent dry perry which would have won high mention in the other class. The first prize exhibit was of very fine flavour.

The following are the results of the chemical analyses of the samples gaining prizes :—

CLASS 454.—*Cask of Dry Cider, not less than* 18 *and not more than* 30 *gallons, made in* 1908.

No.	Specific gravity	Alcohol	Total solids	Acidity	Awards
		per cent.	per cent.	per cent.	
4080	1·0181	4·70	6·07	·495	1st Prize
4065	1·0213	5·70	7·24	·670	2nd Prize
4076	1·026	3·65	7·14	·479	3rd Prize

CLASS 455.—*Cask of Sweet Cider, not less than* 18 *and not more than* 30 *gallons, made in* 1908.

No.	Specific gravity	Alcohol	Total solids	Acidity	Awards
		per cent.	per cent.	per cent.	
4090	1·0327	3·50	9·28	·284	1st Prize
4106	1·0289	2·00	7·84	·335	2nd Prize
4113	1·0317	3·17	9·19	·298	3rd Prize

CLASS 456.—*Cask of Cider, not less than* 18 *and not more than* 30 *gallons, made previous to* 1908.

4120	1·0117	7·05	5·36	·489	1st Prize
4121	1·0158	3·70	5·30	·469	2nd Prize
4125	Analysis not recorded.				3rd Prize

CLASS 457.—*One dozen bottles of Dry Cider, made in* 1908.

4128	1·0234	4·00	7·46	·318	1st Prize, & R.N. for Cup
4134	1·0157	4·20	6·31	·351	2nd Prize
4135	1·0153	4·28	5·22	·345	3rd Prize

CLASS 458.—*One Dozen Bottles of Sweet Cider, made in* 1908.

4158	1·0336	2·96	9·59	·395	1st Prize
4191	1·0474	·75	12·33	·663	2nd Prize
4198	1·0398	2·45	11·22	·425	3rd Prize

CLASS 459.—*One Dozen Bottles of Cider, made previous to* 1908.

4218	1·0364	2·90	10·34	·380	1st Prize and Challenge Cup
4212	1·0269	2·85	7·84	·522	2nd Prize
4211	1·0306	2·70	8·76	·522	3rd Prize

CLASS 460.—*One Dozen Bottles of Dry Perry.*

4222	1·0234	4·20	7·60	·529	1st Prize
4230	1·0215	5·75	7·60	·703	2nd Prize
4229	1·0351	4·40	10·71	·854	3rd Prize

CLASS 461.—*One Dozen Bottles of Sweet Perry.*

4241	1·0396	2·30	10·77	·639	1st Prize
4243	1·041	2·90	11.63	·569	2nd Prize
4240	1·0446	1·15	11·70	·452	3rd Prize

Wool.—The exhibits of wool were all well grown and fully up to the average. Some few samples exhibited signs of tenderness, and several samples were scoured in washing too much, the nature being taken out of them and the lustre injured. The Leicester wools were all well grown and of good lustre. The Lincolns were all well and deep grown, and well got up. The Kent or Romney Marsh showed good quality, but in some instances were tender. The Cotswolds were all deep and good quality wools. The Devons were all very good wools, and the South Devons made a good average show. The class for "Any other Long Wool" made a fair average show of lustre wools. The Southdown wool was good, clean, and well got up. The Shropshire wool made only an average show, but with good staple and fair quality. There were only two exhibits of Kerry Hill, but these were of very clean, soft handling hosiery wool. The "Any other Short Wools" made a very mixed collection, but they were generally of fair quality and well got up. There was a great improvement in Welsh wool, which showed very good quality. The Cheviot was also of good quality, well grown and well got up. The Scotch exhibits were of long strong wool, with all the characteristic qualities.

Hives, Honey, &c.—In this department a splendid show of appliances was made, and bee-keepers desiring to be up to date had the opportunity of seeing the best that most of the leading manufacturers could stage. Only a very few new-season novelties were shown. The first prize went to a very promising invention, capable perhaps of improvements in some details, while the "Simplex" honey-jar was well worth trial. In the Extractor Class the "Cowan" and "Rapid" again deservedly came out first. A tasteful display of honey, staged by Mr. W. Dixon of Leeds, was awarded a first, the second being almost as good, while the third perhaps had better honey in somewhat less attractive form. The honey staged in the other classes scarcely reached the top mark, the Show coming too early for entries only of the present year, and run honey of previous years is apt to lose its aroma, and perhaps delicacy of flavour, when prepared for the Show bench. Comb honey of this season has suffered from weather interruptions just when the bees should have been giving the finish to their best work. The north and west division of the country produced the larger proportion of the best honeys, and this can be traced to climatic differences in 1908 and the early season of 1909. In light extracted honeys all the prizes went to Lincolnshire, Hunts., Somerset, and Gloucestershire, and in dark honeys to the same or districts near. Heather honeys were somewhat disappointing, heather mixtures being somewhat better, but

fewer in number. Wax was a strikingly good feature of the Show.

COMPETITIONS.

Butter-making.—The number of competitors was 102, and the competitions were confined to dairy students who had received instruction in dairying in their respective counties, and who had never won a prize at the Shows of the R.A.S.E., Bath and West, Royal Counties, and at the London Dairy Show. The competitors were, on the whole, a smart, capable lot, and the method of working adopted by them gave very practical results. The different competitions were keenly contested, the work was neatly and smartly done, and the competitors showed evidence of having received a careful training. Eighteen competitors entered for the Championship competition which was held on the last day of the Show, and was only open to prize winners in the preceding classes. This competition was very keenly contested, and the work done by the different competitors was up to a high order of merit, very few marks separating the highest and lowest. The work generally was smartly and neatly done, every attention being given to detail, and the finished product was of excellent quality, with little to be desired in the way of appearance and finish.

Horse-shoeing.—The quality of the work was very good, but it was found, as at Newcastle last year, that although special attention was paid to shoe-making, not sufficient care was taken in many instances with the preparation of the foot and nailing on.

The Society were most cordially received by the County and City, and visitors to the Show will not readily forget the kindness of the Mayor, who, with the Mayoress (Mrs. James Bruton), dispensed the most generous hospitality in their specially erected pavilion in the Showyard.

There is no doubt the daily downpour of rain deterred many intending visitors from attending the Show, and consequently the "takings" at the gates were reduced, so that, for the first time since the return to the country, a small deficit on the Show has to be recorded. Although the financial result may not have been so satisfactory as could have been desired, there was a consensus of opinion that, from the point of excellence, the Gloucester Show of 1909 has never been surpassed.

THOS. MCROW.

16 Bedford Square,
London, W.C.

THE TRIALS OF FRUIT TREE SPRAYING MACHINES AT GLOUCESTER, 1909.

Judges { GEORGE E. CHAMPION, Linton, Maidstone.
MONTAGU C. H. TAYLOR, Shelsley Walsh, Worcester.

THESE trials were held in the orchards of Mr. Martin Chart at Hucclecote, on June 17 and 18. The site was an excellent one, the arrangements were well carried out, and we were able to hold exhaustive trials of the four power machines, and the twenty-six hand machines entered for competition.

CLASS III.—POWER MACHINES.

After a thorough trial we placed No. 183, entered by Messrs. Weeks & Son, first. This consisted of a 5 H.P. oil engine driving three throw plunger pumps. The engine and pumps were mounted on a four wheeled frame, and to this was connected a galvanised storage tank on wheels. The tank contained 150 gallons of mixture and was fitted with agitators worked by the engine. This machine supplied the nozzles on eight lengths of hose pipe at once, delivering 930 gallons per hour, and doing good work with the different mixtures used.

No. 388, Messrs. Drake & Fletcher's machine, placed second, comprised a 3 H.P. two cylinder petrol engine, and a set of two-throw gun metal plunger pumps mounted, with a wooden barrel holding 120 gallons of mixture, on a four wheeled portable trolley. This machine worked well ; supplying eight branch hose pipes and nozzles, and delivering 600 gallons per hour.

The remaining entries consisted of No. 298, shown by the Weald of Kent Engineering Company. A 5 H.P. petrol engine working a set of three plunger pumps, mounted on a frame and wheels, and a 50-gallon tub fitted with handles for carrying. This gave very satisfactory results.

No. 4350, Messrs. Duke & Ockenden's machine, comprising a 3 H.P. petrol engine, and double acting "Admiral" pump mounted on a waggon with a 250-gallon half-round tub, a spraying tower, and a galvanised water tank. This was a somewhat cumbersome plant.

CLASS II.—HAND POWER MACHINES.

The twenty-six hand power machines in Class 2 were, after the exhaustive trials on the first day, reduced to eight.

Of these, No. 182 shown by Messrs. Weeks & Son, and No. 387 entered by Messrs. Drake & Fletcher, were finally placed first and second respectively.

Messrs. Weeks & Son's machine comprised a 35-gallon narrow wooden container, mounted on side wheels 24 in. over all, with a gun-metal pump $2\frac{3}{8}$ in. by 5 in. fitted with ball valves. The pump, which could be quickly removed from the tank for inspection, was easily worked and capable of throwing two powerful jets. This machine did excellent work under all conditions.

Messrs. Drake & Fletcher's machine, a close second to above, consisted of an oval shaped barrel of 18 gallons capacity, mounted on a barrow frame 14 in. over all. The pump was of gun metal with brass ball valves and leather washers to piston. It was an easy working pump and could quickly be removed from the barrel.

No. 199, Messrs. Benton & Stone's 30-gallon machine, had an excellent pump with novel features for altering its position and for agitating and straining the mixture.

No. 242, The Four Oaks Company's 15-gallon machine, designed for closely planted fruit plantations, had a powerful brass pump fitted in a galvanised iron tank mounted on an iron barrow frame, 12 in. over all.

No. 289, entered by Mackies, Ltd., was a machine made to be carried or wheeled. It had a brass pump with ball valves fitted in an 18-gallon oak barrel. The pump was easy working and could easily be removed for inspection.

No. 4301, Messrs. Marshall & Philp's "Fountain" Machine, comprised a 25-gallon galvanised copper lined tank, to which was fitted a gun metal pump with ball valves with a patent adjustable washer. The pump worked easily and could be quickly removed.

No. 236, shown by the Alpha Extinguisher Ltd., was a 5-gallon lead-coated steel container with side handles. The mixture having been put into this, air was pumped in to a pressure of 100 lb. A good spray was maintained for from sixteen to twenty minutes.

No. 162, Messrs. Burland & Son's machine, was a 40-gallon tub mounted on an iron shod sled. It had gun metal plunger pump, and supplied four lengths of hose pipe. This was a useful machine, 24 inches wide over all.

Among the other machines entered were several knapsacks, a form of machine which was not suitable for competition, and not intended to be included under the regulations. No. 243, The Four Oaks Knapsack was a well-made and most excellent machine with the pump and working parts fitted outside the container.

No. 382, one of French make shown by Messrs. Besnard, was worked by air pressure, having an air pump fitted outside the lead-coated steel container. This machine did good work.

No. 1468, Messrs. Mayfarth & Co.'s "Syphonia Knapsack" was a 2¼-gallon lead-coated steel container worked by air pressure, the liquid being pumped into the container.

Of the nozzles used in the trials, we found the large "Seneca" pattern the best for lime and salt spraying, and for the Bordeaux Mixture, Messrs. Weeks & Son's "Multi-spray" nozzle, the "Mistry" pattern, and the "W.E.K." did the best work. As a general purpose nozzle, Messrs. Drake & Fletcher's adjustable "Mistifier" was very satisfactory.

A word should be said with regard to the spray mixtures used in the trials. While the lime and salt wash and the Bordeaux Mixture were sufficiently satisfactory for the purpose we had in view, viz., to test the machines, yet owing to the very poor quality of the lime and of the bluestone provided, they would have been quite unsuitable for use in a commercial fruit plantation. We mention this only in order to remind growers, many of whom took advantage of the Society's courtesy to view the trials, of the importance of taking the greatest care in the purchase of the materials and in the mixing of the spray fluids.

In conclusion, we were much indebted to Mr. Martin Chart for the excellent preparations he had made in his gardens for conducting these trials; and we also desire to express our thanks to the Stewards of Implements, Mr. R. M. Greaves and Mr. Claude M. S. Pilkington, for their assistance, and to the Consulting Engineer, Mr. F. S. Courtney, for the help he gave us in carrying out our duties.

MONTAGU C. H. TAYLOR.
GEO. E. CHAMPION.

THE TRIALS OF HOP-DRYING PLANT, 1909.

Judges { WALTER R. ELGAR, Sittingbourne, Kent. JOHN POWELL, Lower Wick, Worcester.

IN response to the Society's offer of 100*l*. as a prize for the best Hop-Drying Apparatus, there were four entries, viz. :—

Mr. A. F. Partridge	Leominster.
Mr. E. G. Shew	Ledbury.
Messrs. Whiting Bros.	Faversham, Kent.
Messrs. Williamson & Allen . . .	Gloucester.

In the Regulations which were sent to the several competitors features which were considered of special importance were set out as follows :—

Efficiency of work.
Adaptability to different kinds of existing oasts (unless the plant is self-contained).
Facility for regulating heat and draught, also for cooling.
Economy of working.
Time required for drying.
Construction.
Prime cost.

In order that the trials should be as complete as possible, it was arranged that they should be continued throughout the whole period of hop-drying, and during that period each kiln was in the charge of two observers, who kept accurate record of all that transpired at each oasting, including such items as quantity and description of fuel and quantity of sulphur used, temperature at different times and at different parts of the hair during process of drying, weight of green hops loaded on each kiln, supervision of pressing or bagging and weighing of dried hops. They also put the stamp of the Society upon the pockets, and the samples were drawn in their presence, so that nothing was omitted, that experience and judgment could foresee, so that the trials should be of a thoroughly straightforward and practical nature, for we recognised that unless these requirements were fulfilled strictly and to the uttermost the expectation of good likely to follow, as a result of the generous prize offered by the Society, would be, to a large extent, at any rate, nullified.

Before starting upon our judging, a system of "marks" was agreed upon, with the proportionate maximum under various headings.

The competition was strictly limited to the efficient working of the apparatus itself, the resultant sample of dried hops being examined solely with the view of ascertaining how the hops composing that sample had been treated, quite irrespective of the quality, size, or variety of the hops themselves.

It will be noted that there were three west country machines and one Kent machine competing, and it was arranged that the west country machines should be under the charge of Kent observers, and that the Kent machines should be in charge of west country observers.

To ensure that the machines should all be in readiness, and the arrangements for weighing, &c., during the trials should be complete, a preliminary inspection was made by the two Judges and the Consulting Engineer of the Society.

The first plant to be inspected was that entered by Messrs. Williamson & Allen, manufactured under Joyces' Patent. It consisted of a gill stove or furnace, enclosed in a vertical rectangular galvanised iron shaft, about 6 ft. square. The furnace was fitted with hollow fire bars, the air passing through which was collected in a pipe leading up the shaft, and delivered into the upper part of the kiln above the hops.

The furnace gases were conducted up another pipe in the shaft, and delivered free of the kiln to the outside atmosphere.

The bottom of the shaft was open for some height above the ground to allow of the access of air to the outside gill surfaces of the stove, such openings being regulated by sliding dampers.

On the front face of the shaft is a horizontal hinged flap or door, this is kept closed when the hops are being dried, but when cooling is desired it is thrown open, or across the shaft, thus arresting the ascending column of hot air. The shaft terminates about 4 ft. 6 in. below the hair, which it is claimed allows for an even distribution of temperature under the hair and through the hops.

From the above description it will be seen that this plant, like the open fire kilns, depends solely upon natural draught for transmitting the hot gases through the kiln. There is no fan.

Unfortunately Messrs. Williamson & Allen were obliged to withdraw this machine from the competition, owing to an objection raised by the owner of the oasts as to the conduct of the trials. This was much regretted.

The next plant to be examined was that by Messrs. Whiting Bros., manufactured under Neames' Patent, and erected in one of Mr. F. Neame's oasts at Tinbridge, Faversham.

The plant consists of a plain cast-iron cylindrical vertical furnace, fixed on the floor of the kiln. The hot gases from the furnace are led across the kiln in four cast-iron pipes, slightly rising, to a distribution box fixed on the opposite wall. From this distribution box two 8 in. pipes branch, one right and the other left, encircling the inside of the kiln, and then return across the centre of the kiln to the back, and there deliver into a brick chimney. The general arrangement is seen from the accompanying plan and section, Fig. 1. Openings are provided on the ground level around all sides of the kiln for the access of air, such openings being regulated by dampers.

The furnace is, of course, also provided with a damper to regulate the fire, and it was found to be quite efficient in operation.

During the trials for the first week, the fuel used consisted of coal or coke in equal quantities, after which coke alone was used for six days, and the last two days wood with a little coke.

This plant has no fan and depends entirely on natural draught.

Sulphuring is effected in the ordinary way, with an independent sulphur stove. The cost of this plant fixed is quoted at 75*l*.

On August 9, Mr. Shew's plant at Bosbury, near Ledbury, was the first to be examined. Here there were three kilns, each fitted with its own gill furnace and radiating pipes.

The special feature in this plant is the arrangement of the radiating pipes, which are composed of a battery of twelve inclined V pipes, illustrated in plan and elevation by Fig. 2. The object of this arrangement is to ensure the uniform distribution of the heated air under the hair.

The air is blown into the kilns through suitable conduits by two fans, one fan capable of delivering 9,000 cubic feet per minute delivering into one kiln 16 ft. square, the other larger fan with a capacity of 25,000 cubic feet per minute delivering into the two other kilns, each 15 ft. square.

The fans were driven by a portable steam engine, and when running maintained an air pressure in the lower portion of the kiln equal to about one-tenth of an inch of water. For the purposes of trial, the three kilns were treated collectively as one.

It is claimed for this system that it will also work without the aid of fans by natural draught, though when so doing the output would be less than when working with forced draught. Two oastings were made in this way in one of the kilns, and although the air inlets were not arranged for efficient working with natural draught, the result proved that the plant would work efficiently without forced draught.

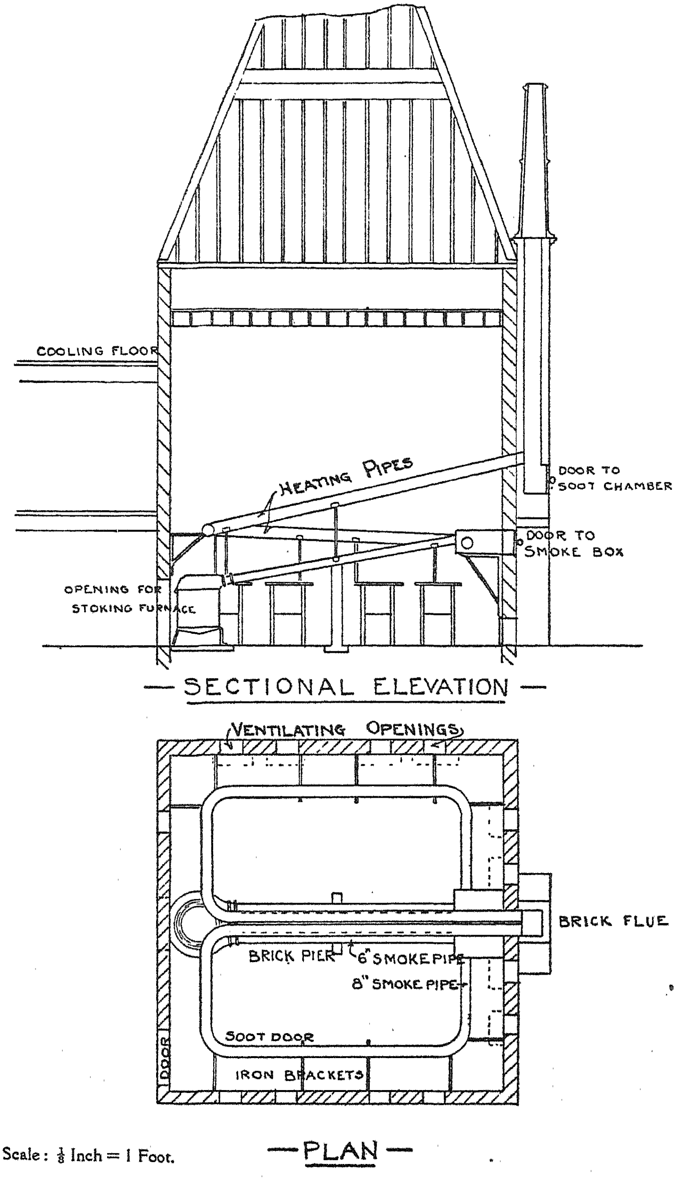

FIG. 1.—Neame's Patent Pure Air Furnace for Drying Hops.
Entered for competition by Whiting Bros.

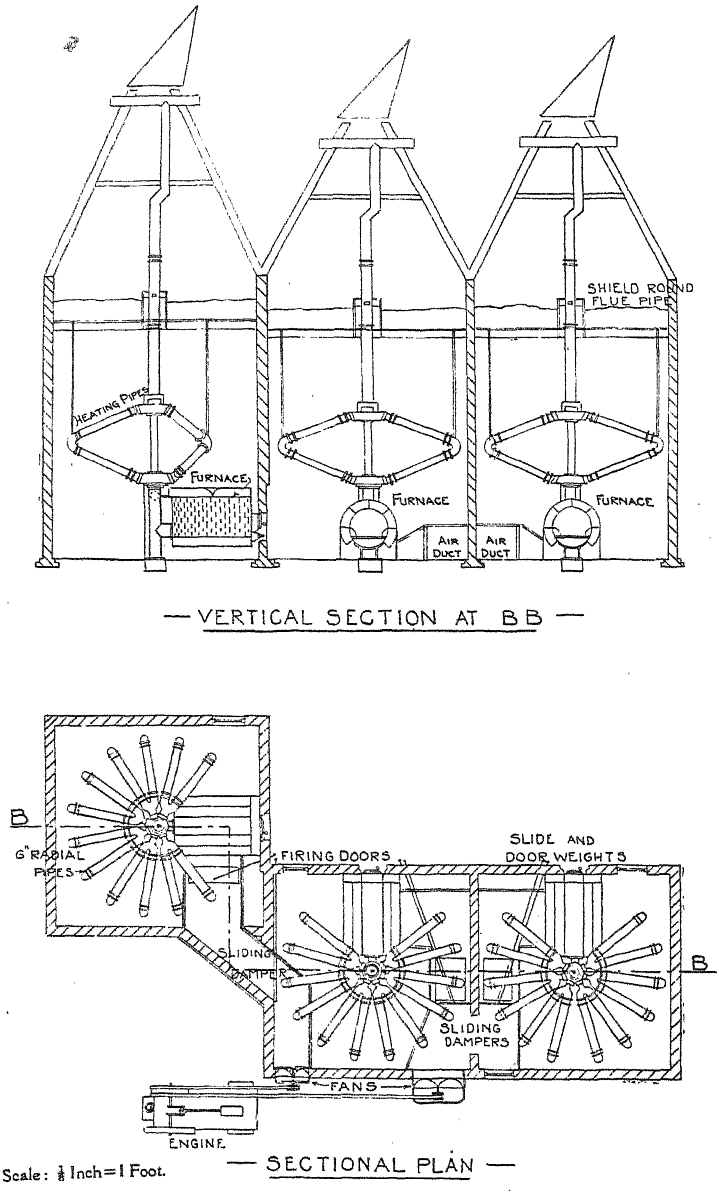

FIG. 2.—Shew's Patent Economic Hop Drier.
Entered for competition by E. G. Shew.

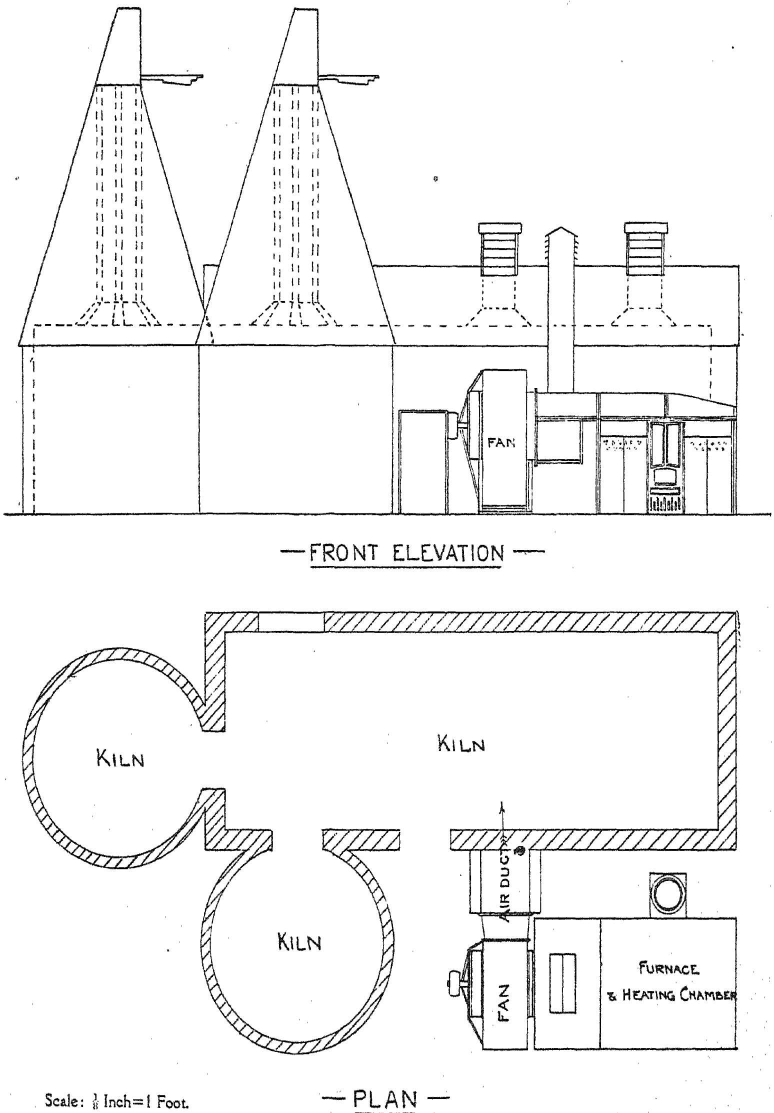

FIG. 3.—Davidson's Patent "Sirocco" Drying Apparatus to Hop Kiln. Entered for competition by A. F. Partridge.

The price of the plant fixed complete, but exclusive of engine and builder's work, was quoted at 252*l*.

Mr. Partridge's plant at Wharton Court, Leominster, was likewise adapted to three kilns, two of which were circular and the third rectangular, shown in Fig. 3.

It consists of a furnace with a multitubular heater, with fifty 3 in. wrought-iron tubes, 6 ft. long, and a sirocco fan 50 in. in diameter by 30 in. wide, driven by a fixed horizontal oil engine.

The fan is placed between the heater and the kiln; in this way the outside air is drawn through the heating tubes, the hot flue gases traversing round them, and the air thus heated is then delivered under about one-eighth of an inch water pressure through a delivery culvert into the lower portion of the rectangular kiln, part finding its way through the door openings to the two circular kilns.

The method adopted in working this particular plant differed from that of the other plants, in that instead of doing two oastings in the twenty-four hours, the whole of one day's picking is treated in one oasting at night. This method of working certainly necessitates a larger plant than would be required if the drying was done in two oastings, but there is nothing inherent in the system to prevent the drying being so done.

TRIALS.

In order that the records should be as uniform as possible, each observer was equipped with a series of log-sheets, on which were tabulated all the observations taken during each oasting.

The weight of green hops at each oasting was recorded, as also the weight of fuel, the variation of temperature every three hours, as well as the maximum temperatures at different positions on the hair for each oasting. The dried hops were subsequently weighed, but it was found impracticable, without unduly inconveniencing the operators, to keep the exact weight of each oasting separate, as it frequently occurred that there was a shortage of hops to completely fill the last pocket, or that there might be a small quantity of hops in excess which would be carried on to the next oasting. The total quantity for each trial is, however, correct.

The figures given in the Table on p. 203 are the mean figures recorded during the whole period of trial; at the end of the table is given the maximum outputs for any one oasting of the competing plants, and these readings may be taken as the correct record of the capacity of the plant rather than the mean readings, which, to some extent, were affected by irregularity in the quantity of green hops in an oasting.

Royal Agricultural Society of England.

RESULTS OF TRIALS OF HOP-DRYING PLANTS.

	A¹ (1 to 10)	A² (11 to 16)	A³ (17 to 22)	C	D	
		Whiting Brothers		E. G. Shew	A. F. Partridge	
	Fuel=Coal and Coke.	*Fuel=Coke.*	*Fuel=Wood and Coke.*	*Fuel=Coke.*	*Fuel=Coal.*	
Date	Sept. 6 to Sept. 11, 1909	Sept. 11 to Sept. 16, 1909	Sept. 16 to Sept. 18, 1909	Sept. 13 to Sept. 28, 1909	Sept. 14 to Sept. 22, 1909	1
Number and duration of Oastings	10—Total 110 hours	6—Total 62·416 hours	6—Total 65·083 hours	26—Total 273·5 hours	8—Total 94·33 hours	2
Kind of Hops	Early Birds, Bramlins, Cobs Goldings	Cobs Goldings	Canterbury Goldings	Bramlins, Mathons, Fuggles	Bramlins, Mathons, Fuggles	3
Superficial Area of Hair	400 sq. ft.	400 sq. ft.	400 sq. ft.	706 sq. ft.	785·1 sq. ft.	4
Temperature of Hot Air in Kiln	Min. 80°, max. 168°	Min. 93°, max. 159°	Min. 90°, max. 141°	Min. 70°, max. 170°	Min. 95°, max. 129°	5
Fuel	Coal 18·7 cwt., coke 22·75 cwt. Total 41·5 cwt.	Coke 23 cwt.	Coke 8·5 cwt., wood 30 cwt. Total 38·5 cwt.	Coke 223 cwt.	Coal 105·75 cwt.	6
Green Hops, total Weight	180·2 cwt.	95·95 cwt.	86·237 cwt.	969·8 cwt.	673·593 cwt.	7
Dried Hops, total Weight	39·54 cwt.	19·93 cwt.	19·901 cwt.	216·5 cwt.	142·58 cwt.	8
Reduction in Weight	78·05 per cent.	79·22 per cent.	76·92 per cent.	77 per cent.	78·83 per cent.	9
Output Dried Hops per hour	0·359 cwt.	0·319 cwt.	0·305 cwt.	0·791 cwt.	1·511 cwt.	10
Output Dried Hops per hundred square feet of Hair per hour	0·089 cwt.	0·079 cwt.	0·076 cwt.	0·112 cwt.	0·192 cwt.	11
Output Dried Hops per cwt. of Fuel	0·952 cwt.	0·866 cwt.	0·517 cwt.	0·97 cwt.	1·348 cwt.	12
Fuel used per cwt. of Output	1·05 cwt.	1·16 cwt.	1·93 cwt.	1·03 cwt.	0·74 cwt.	13
Price of Plant	75*l.*	75*l.*	75*l.*	252*l.*	425*l.*	14
Output per hour for each 100*l.* cost of Plant	0·478 cwt.	0·423 cwt.	0·406 cwt.	0·313 cwt.	0·355 cwt.	15
Maximum Oastings—						
Output Dried Hops per hour	0·561 cwt.	0·526 cwt.	0·346 cwt.	1·09 cwt.	1·663 cwt.	16
Output Dried Hops per hundred square feet of Hair per hour	0·140 cwt.	0·132 cwt.	0·087 cwt.	0·154 cwt.	0·212 cwt.	17

The fuel used varied in each case, and this has to be borne in mind when considering the quantity of "fuel used per cwt. of output."

In the case of Messrs. Whiting, coal and coke in approximately equal quantities was used for six days, then coke alone for five days, and wood and coke for two days.

With Mr. Shew's plant coke alone was used throughout the trials, while with Mr. Partridge's plant coal alone was used.

The temperatures generally were very equally divided over different parts of the kilns. The trials show clearly the very largely-increased output obtainable per square foot of hair where forced draught is used.

In comparing the amount of power taken to work the fans in Mr. Shew's case, there is a portable steam engine, which, though unnecessarily large for the work it has to do, is yet available for doing whatever other work may be required during the remaining part of the year.

Mr. Partridge, on the other hand, has a fixed oil engine for driving his fans.

A comparison between these two would hardly give a fair conclusion.

For work which only occupies a few weeks in the year it is better to assume that the power would be hired. The smallest portable engine one would be likely to get would be 8 H.P., which would be more than sufficient to drive either plant.

Messrs. Whiting commenced their trials on September 6, finishing on September 18. The trials proceeded with remarkable uniformity. Only one kiln being under trial, it was an easy matter to regulate the amount of green hops in each oasting. With Messrs. Shew's and Partridge's oastings it was impossible to get the same uniformity as, all three kilns being treated as one, if there was any shortage in the day's picking, it affected the load in the kiln.

Mr. Shew commenced his trials on September 13 and concluded on September 28.

Mr. Partridge commenced his trials on September 14 and concluded on September 22.

At the conclusion of the oasting samples of dried hops were taken from one of the pockets of each oasting, in the presence of one of the observers in charge of the trials, and were submitted to the inspection of the Judges, as well as to an independent hop merchant and hop factor.

It is interesting to note that the maximum depths of green hops in the kilns were as follows:—

Neame's (Whiting) . .	12 inches.
Shew's	22 ,,
Partridge's . . .	31 ,,

We do not consider that any of the plants shown have by any means reached mechanically the standard of excellence that is desired, but one must not lose sight of the conditions that pertain to a plant of the sort that is only in use for say three weeks or a month during the year; therefore the prime cost has to be worked off, as it were, in a very short space of time.

Two of the plants that we judged, viz., Shew's and Partridge's, used forced draught, and by this means very many more hops can be dried on a limited kiln space than with natural draught, as with Mr. Neame's system, but we feel bound to point out that where there is plenty of kiln room we do not think there is any advantage in either of the forced draught systems over Mr. Neame's.

After various personal inspections and most carefully going into the figures and details, and weighing up the various reports, we came to the conclusion that Mr. Shew's plant was the best of those entered, and in conclusion we desire to express our deep gratitude and appreciation of the help and advice on the engineering points that we received from Mr. Courtney, the Society's Engineer, to whom we are also indebted for arranging, preparing, and tabulating the various log books. We also wish to express our thanks to Mr. Basil Richardson, partner in the well known firm of Wigan & Co., Hop Merchants, and Mr. Sydney Smith, of Messrs. Pattenden & Smith, Hop Factors, who assisted us in judging the samples.

The analyses of the samples were made by Mr. Lawrence Briant, of Holborn Viaduct, in the most careful and thorough manner, and we are obliged to him for the great pains he took over the work.

We also feel indebted to the Assistants for the careful and efficient manner in which they performed the work entrusted to them.

It now only remains for us to say that we are quite satisfied in our own minds as to the genuineness and thoroughness with which the trials have been conducted, and trust that the results, including the most valuable set of figures marked "A" in the Appendix, may be of practical use to hop growers generally and ultimately repay the outlay so generously provided by the Royal Agricultural Society.

WALTER R. ELGAR.
JOHN POWELL.

Report upon samples of hops in connection with tests of kiln drying made under the control of the Royal Agricultural Society:—

Name	Mark	Moisture percentage	
		Green	Dried
Whitings . . .	A/6	79·90	9·50
” . . .	A/13	75·65	9·90
” . . .	A/17	82·95	9·40
Shew . . .	C/5	80·75	7·25
” . . .	C/13	81·20	11·45
Partridge . . .	D/Bramlins	80·40	7·20
” . . .	D/Mathon	80·00	13·30
” . . .	D/Fuggles	79·60	14·75

Name	Mark	Original total. Resins of green hops expressed on dry hops	Resins in dried hops calculated on moisture free hops		
			Soft	Hard	Total
Whitings . .	A/6	16·66	12·93	3·31	16·24
” . .	A/13	13·05	11·21	1·89	13·10
” . .	A/17	15·98	11·70	2·12	13·82
Shew . .	C/5	13·42	11·42	2·26	13·68
” . . .	C/13	13·84	11·87	2·26	14·13
Partridge . .	D/Bramlins	15·28	12·72	2·37	15·09
” . .	D/Mathon	12·55	10·50	2·31	12·81
” . .	D/Fuggles	13·91	10·20	2·46	12·66

In connection with the above figures I have to make the following observations :—

(1) The whole of these samples represent hops of good quality as measured by the resins. The soft resins—these being to a large extent the measure of the preservative value—are high, and the hard resins which are of little or no preservative value are low.

(2) In no case has any considerable loss occurred between the total resins present in the green hops and those found in the dry hops, thus showing that the methods of drying adopted have been such that no undue disintegration of the hops with consequent loss of resins has occurred. In this respect the whole of the samples are satisfactory.

(3) The moisture percentage in the dry hops is satisfactorily low in the bulk of the samples, and assuming that for the purpose of a good keeping hop it is not desirable that the moisture percentage should exceed 10 per cent., then it will be seen that five out of eight samples conform to that suggested standard. In some of the samples, however, the moisture is decidedly high, this being the case most markedly in "Partridge D. Fuggles," in which I consider the moisture to be seriously high, whilst it is higher than desirable in "Shew C/13" and "Partridge Mathon."

(4) I have been requested to allot marks to the samples on the following points :—

A. Resins.
B. Moisture.
C. Arsenic.

And taking perfection as 10, I place the samples in the following order :—

(A) *Resins.* Shew 8, Partridge 8, Whiting 7.

These figures refer not to the total resins present, but to the difference in resins between the green hops and the dried hops and the character of those resins.

(B) *Moisture.* Whiting 10, Shew 9, Partridge 8.
(C) *Arsenic.* Partridge 9, Whiting 8, Shew 8.

The exact figures of arsenic are not given, but the average of each of these samples conforms to what I consider is a fair standard of not containing more than one-fiftieth of a grain of arsenic per lb.

LAWRENCE BRIANT.

MISCELLANEOUS IMPLEMENTS EXHIBITED AT GLOUCESTER, 1909.

New Implements.

Fifty-four implements of the most varying description were entered under this head for the Society's Silver Medal; one was not present and one had been damaged in transit, leaving fifty-two to be examined. Out of these the Judges recommended three for the Silver Medal. Five of the remaining entries were for Potato Diggers, but it was considered impossible to come to any decision as to these without a competitive trial, and it is hoped the Council may be able to arrange for such at an early date. Two other entries were Turnip Thinners. Endeavours were made, but unfortunately without success, to find a field (of turnips) where these could be tried, and it was therefore impossible to come to a definite opinion as to their respective merits.

Silver medals were awarded to the three entries described below:—

No. 1134.—*Cart, Farmer's Road and Farm*, with combined Patent Tipping and Brake arrangements to take weight off horse's back. Price 23*l*.—Exhibited by William Ball & Son, Ltd., Rothwell, near Kettering.

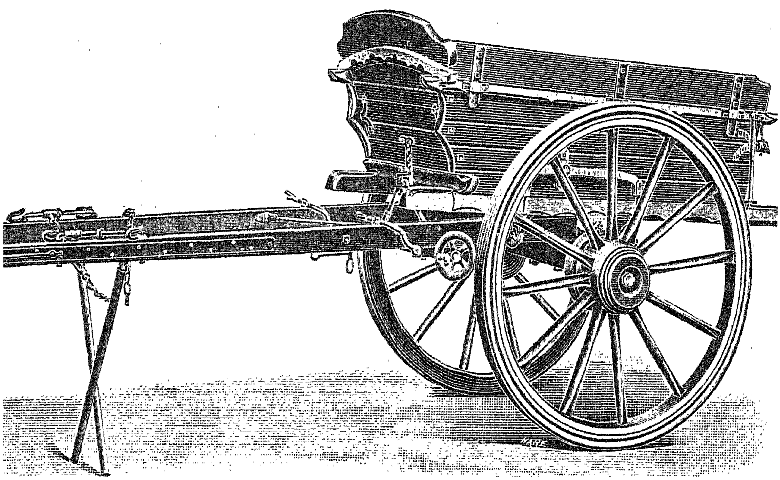

Fig. 1.—Farmer's Road and Farm Cart.

Note.—The patent automatic brakes and tipping gear can be supplied separately for 4*l*. 7*s*. 6*d*., including fixing.

In this gear the action of applying the brakes, automatically tips the body, so that the weight is partially taken off the horse's back when descending a hill. Some tests made in the showyard showed that the horse was relieved of approximately one third the load on his back. The apparatus is simple and unlikely to get out of order, and would appear to be of considerable value in hilly country.

No. 2152.—*Harrow, Zigzag*, with reversible tines, solid frame. Price 4*l*. 15*s*.—Exhibited by Lott & Walne, Ltd., The Foundry, Dorchester. The tines are made of square bar, double the usual length, and bent at right angles in the middle, they are held in place by the horizontal member being slipped under a clip which is then tightened down by a single set bolt. It is indifferent which end of the tine is pointing downwards, the life of the tine is therefore doubled and the objectionable weak screwed end is done away with.

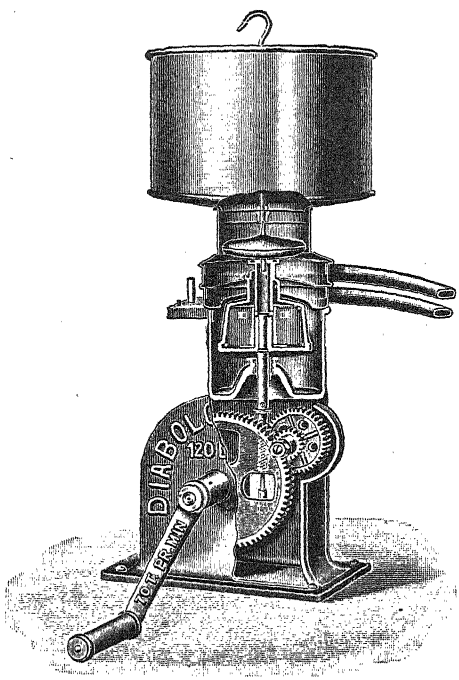

FIG. 2.—Diabolo Cream Separator.

No. 3139.—*Cream Separator*, "*Diabolo.*" Manufactured by the Aktiebolaget Pump Separator Company, Stockholm, capacity 27 gallons per hour. Price 4*l*. 4*s*.—Exhibited by R. J.

Fullwood & Bland, 31 Bevenden Street, Hoxton, London, N. Small and neat in appearance, easily worked, and is fully up to its stated capacity. The average of cream separated is quite satisfactory as shown by tests made for the Judges. In view of its low price the machine appears worth the consideration of those who require a small separator.

OTHER "NEW" IMPLEMENTS.

No. 3735.—*Crude Oil Engine*, 16½ B.H.P. Price 160*l.*—Exhibited by Blackstone & Co., Ltd., Stamford. This, as a good example of a crude oil burning engine, was subjected to a thorough examination and trial by the Judges. It may here be

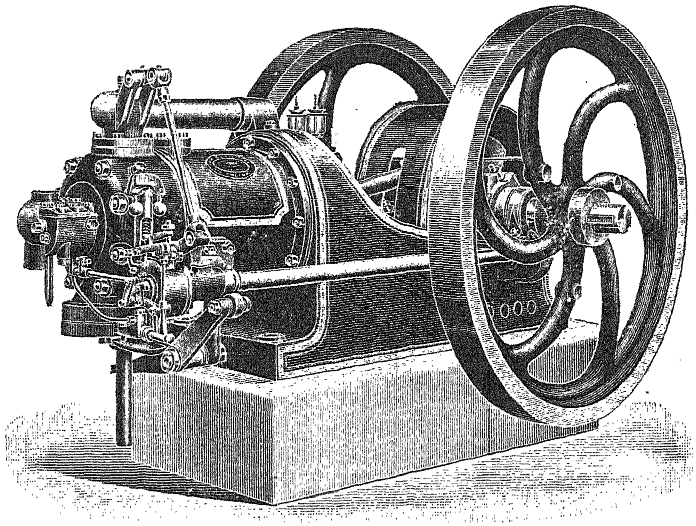

FIG. 3.—Crude Oil Engine.

mentioned that crude oils somewhat resemble Creosote in appearance and smell, and vary in thickness from Scotch shale oil, which is quite limpid, to Canadian, which is nearly as thick as treacle. It is therefore of much importance that a crude oil engine should be capable of dealing with any brand of crude oil without modification or adjustment being required. The Blackstone engine, when tested with various brands of oil, appeared to be quite indifferent to what it was burning, and even with the most varying brands no difference was perceptible either in horse-power or revolutions. No adjustment of any kind was made during these trials. One of the great difficulties in using crude oil is fouling of the cylinder and piston head with a deposit of carbon due to imperfect

carburation. To satisfy ourselves on this point we had one of the Blackstone engines opened up ; this engine had done some weeks' work without being opened up or the internal parts cleaned. The deposit we found was too slight to be of any importance, even the head of the air inlet valve—which owing to its comparative coolness always shows the heaviest deposit—was practically clean. Whilst running, the exhaust was clear and almost without objectionable odour.

The engine was subjected to a three-hours' full power run under the supervision of the Society's Engineer, Mr. Courtney, C.E., during which time it gave off 27·4 H.P. being 60·5 per cent. above the catalogue H.P. No trouble of any kind occurred, nor were any adjustments made. The run was made on Crude Texas Oil, costing 50*s*. per ton or about 2½*d*. per gallon, the amount consumed being ·58 of a pint per B.H.P. per hour, the cost of fuel per H.P. per hour working out at ·181 of a penny.

The importance of this extraordinary economy may be judged by comparing the cost of running on paraffin or petrol and presuming, as is probably correct, that an equal amount be burnt per H.P.

		Cost per H.P. per hour.
Crude Oil	2½d. per gallon	·181
Paraffin	8d. „ „	·562
Petrol	15d. „ „	1·100

or taking crude oil as unity, then—

Crude Oil	1·00
Paraffin	3·12
Petrol	6·08

which compares very favourably with the cost of producer gas engines. A very strong point in favour of crude oil is its freedom from danger and uselessness for any other purpose than that for which it is intended. Crude Texas is almost uninflammable, in fact a bucketfull thrown on to a fire of shavings and sticks will act almost as if it were water instead of oil. In view of the great danger attaching to the use of petrol in and about farm buildings and the higher fire insurance premium demanded where used, this point is of special value. Appended is Mr. H. Stanger's analysis of the Crude Texas used in above trials.

[Copy].

R. H. H. STANGER,

2, Broadway,
Westminster, S.W.
July 3rd, 1909.

DEAR SIR, *Sample of Oil for Test.*

In accordance with your instructions of the 30th ult. I have tested the sample of oil (Crude Texan) received therewith, and now beg to report the results obtained.

Specific Gravity at 60° F.=·9435.
Flash Point (close test)=246 F. (=119° C.).

Calorific Value.

Calories	10500.
British Thermal Units	18900.
Evaporative Power	19·59 lbs.

Yours faithfully,

(*Signed*) R. H. HARRY STANGER.

F. S. COURTNEY, Esq., M.Inst.C.E., &c.,
25, Victoria Street, S.W.

No. 3758.—The 80-*B.H.P. Crude Oil Marine Engine*, price 525*l*, exhibited in motion at the same stand, though it can hardly be deemed an Agricultural Implement, deserves mention on account of the ease of handling, the reversing especially being as quick and certain as a steam engine.

No. 3883.—*A 20-H.P. Agricultural Motor Tractor*, fitted as a mowing machine, the cutter bar being driven direct by an eccentric on the main shaft.—Exhibited by the Cyclone Agricultural Tractor Company, Ltd. This cutter bar may be removed and the tractor then used for drawing a 2-furrow plough or an 11-tine cultivator. It will drive a 4 ft. 6 in. threshing machine, &c. The engine is water cooled.

No. 3884.—*Light Self-propelling Motor of 4 or 7 H.P.*—Exhibited by H. P. Saunderson & Co., Ltd., Elstow Works, Bedford. This may be used either with a removable body capable of carrying a load of half or one ton respectively or with body removed, for any agricultural purpose. The engine is air cooled, a current of air being driven on to the gilled cylinder by a small fan. It is stated that this arrangement is found perfectly satisfactory in practice.

It may be remarked that if air cooling be found sufficient it will be an advantage in every way, lightness, economy in first cost, simplicity, and freedom from breakdown due to the freezing of the cooling water resulting in cracked pipes or cylinder. Very little has been done with air cooling in England, but in the United States where the weather conditions are much more severe, greater precautions have to be taken to prevent freezing, and air cooling is largely used; engines of 45-50 H.P. have been thus made and are stated to work well. The R.A.S.E. trials of Motor Tractors which will take place at Liverpool next year will doubtless throw a great deal of light on this and other questions.

No. 4055. — 3-*H.P. Petrol Engine*, "*Little Eagle.*"—Exhibited by the Eagle Engineering Company, Warwick. This is a small vertical stationary engine fitted with low tension magneto ignition. The cylinder jacket has a thin lead plate about 2 in. by 1 in. fitted into it which is supposed to give way in the event of the water freezing in the jacket.

No. 389.—*Dustifier.*—Exhibited by Drake & Fletcher, Maidstone. A machine for blowing dry powder, such as lime, sulphur, &c., over growing plants, especially strawberries, and currant and gooseberry bushes. Price: two rows, 10*l.*; four rows, 15*l.* The machine consists of a fan driven by cut gears (unenclosed) off the front road wheel. The powder to be applied is carried in a hopper and fed to the fan through an adjustable opening. The air and powder are delivered through two or four india-rubber pipes over the rows being treated. The machine was tested by the Judges, who considered that it was ingenious and did its work with a certain degree of merit, but that it was capable of considerable improvement in details.

No. 1553.—*Sorting Machine for Peas, Beans, Grain, Seeds, &c.* Price 80*l.*—Exhibited by Robert Boby, Ltd., St. Andrew's Works, Bury St. Edmunds. A wide endless india-rubber belt travels over rollers which are tilted to a slight angle. The seed is delivered from a hopper through an adjustable slide on to the top incoming edge; as the belt travels slowly forward the seeds get a compound motion, one forward due to the belt, and the other downward at right angles to the belt due to gravity, the result being that the sound, well-shaped seeds travel faster across the belt than the light or mal-shaped ones; at the low edge of the belt are a series of receiving hoppers, the good seeds drop off the belt into the hoppers nearest to the starting end, the lighter part are carried further on and drop into the next receptacles, and the lightest and worst are not delivered sideways at all, but carried over the end roller. When working on seeds of such shape as would roll with difficulty, small slats are fixed on to the supporting rollers under the upper side of the belt so as to give a shaking motion. The principle is the same as has been employed for many years in sorting shot, and should work well for such seeds as it can deal with.

No. 4674.—*Safety Timber Carriage*, manufactured by G. Stephenson & Sons, Newark-on-Trent. Price 40*l.*—Exhibited by George Woodward, Maythorne, Southwell, Notts. The axle of a timber waggon is bent upwards into a U-shaped arch, through the centre of which is dropped a long square thread bolt provided with double swan hook at bottom, and the bolt is worked by a capstan nut with four long arms and sufficiently powerful for one man to lift a two ton load. After the timber is lifted well up, two V-shaped irons are hung on to the under side of the carriage frame and the timber lowered into them, where it rests securely and without requiring any further fastening. The man, being always above his load, it is claimed is safe in event of the timber slipping or the snapping of a chain link. The whole waggon weighs 18 cwt., and, provided

the arched axle is made strong enough not to be wrenched out of shape in bad ground, it should do its work well.

Nos. 302, 303, and 304.—*Grubbing Jack, Log Jack,* and *Grubbing Machine.* Prices, 5*l.* 15*s.*, 3*l.* 10*s.*, and 35*l.*—Exhibited by Trewhella Bros., 6 Alma Street, Soho, Smethwick, Birmingham. The two first are lifting jacks of different sizes, specially designed for grubbing tree stumps. The last is a special design of crab winch worked by a horse for pulling standing timber out of the ground.

No. 3734.—*Side Delivery Rake.* Price 15*l.*—Exhibited by Blackstone & Co., Ltd., Stamford. Three long parallel rakes are fitted across the frame, and are given a vertical and horizontal movement by a simple and ingenious motion. The rake at the rear passes over the other two and comes to the front once each complete movement, thus wiping off any hay from the prongs, and the hay collected is delivered at one side of the machine. The machine is light and of easy draught for one horse, but no opinion can be given as to its working without a thorough trial.

No. 1934.—*Pasteuriser.*—Exhibited by the Dairy Supply Company, Ltd., Museum Street, London, W.C. An improvement on similar machine previously exhibited, the fan driving gear being placed below the milk-containing vessel instead of above, thus making the vessel much more accessible for cleaning, &c., and preventing the possibility of any oil getting into the milk.

No. 1786.—*Railway Milk Churn.* Price 1*l.* 10*s.*—Exhibited by Vipan & Headly, Gallowtree Gate, Leicester. An improvement on last year's design, which was found to be liable to be damaged by rough treatment. The one now exhibited has a loose locking ring, which protects the lid and prevents the possibility of any water getting into the milk through the joint of the lid.

No. 3770.—*Root Cleaner and Cutter.* Price 13*l.* 10*s.*—Exhibited by E. H. Bentall & Co., Heybridge, Maldon. The novelty consists in making about one half the longitudinal bars of the cleaner of rectangular section twisted into a spiral. These bars are rotated by friction-driven wheels in such manner as to retard the passage of the roots through the cage so that the dirt, &c., is more thoroughly removed.

No. 4378.—*Wind-Turbine Electric Plant.* Price 328*l.* including battery.—Exhibited by J. G. Childs & Co., Ltd., Hawthorn Road, Willesden Green, London, N.W. A "wind turbine," more commonly known as an American windmill, 24 ft. in diameter, of about 10 H.P., drives a dynamo which, when running fast enough to give a predetermined voltage, switches in automatically to a battery of accumulators, and similarly cuts out when the speed of wheel is too low. The

current stored can of course be used for any purpose. As in similar plants used for storing water, the intermittent action compels the use of a large and therefore expensive storage system.

No. 4182.—*Oil Engine.* 22 B.H.P. Price 244*l.*—Exhibited by James B. Petter & Sons, Ltd., Nautilus Works, Yeovil. Engine using crude oil, which is heated to a definite fluidity and thence passes through an adjustable valve on its way to the cylinder, the arrangement being designed to facilitate the use of crude oils of varying densities.

MISCELLANEOUS IMPLEMENTS.

No less than 4,682 entries were made under this head as compared with 4,481 in 1908 at Newcastle, 4,762 in 1907 at Lincoln, and 4,772 in 1906 at Derby. The attention of the Judges was more particularly directed to the following:—

Fruit Tree Spraying Machines.—No less than thirty of these were entered for the prizes offered by the Society. The results of this trial will be found embodied in the report by the Judges, and need not be further mentioned here. The same applies to hop drying plants, of which four were entered, and which will be tried during the hop-drying season of this year.

Nos. 428-431.—*Road Tarring Machines.*—Exhibited by the Phœnix Engineering Company, Chard, Somerset. In view of the damage done to vegetation in the vicinity of main roads by dust, and the great interest taken on the subject of repairs and cost, it is somewhat surprising that this was the only entry for dust prevention machines, and the Phœnix Engineering Company deserve credit for their enterprise.

No. 516.—*Fence Making Machine.* Price 15*l.* 15*s.*—Exhibited by Bacon & Curtis, Ltd., High Street, Poole, Dorset. For making the well-known "Peignon" chestnut or other similar fencing. Appeared to do its work well, and should be of value on large estates where such fencing is used, or by manufacturers in the country where suitable timber is available.

No. 579.—*Steam Motor Waggon, 5-ton.* Price 600*l.*—Exhibited by Richard Garrett & Sons, Ltd., Leiston Works, Leiston, Suffolk. Fitted with superheater in smoke-box capable of giving the steam about 100° of superheat; also with feed water heater, claimed to give an economy of 20 to 25 per cent. in coal and water.

No. 576. *Portable Engine of* 34 *B.H.P.*, single cylinder, fitted with superheater in smoke-box giving about 225° superheat to steam, consisting of rows of pipes bent to and fro and arranged in parallel above the top row of tubes in smoke-box. Engine is also fitted with feed water heater, a shaft governor

directly controlling the eccentric and piston valve. This engine is interesting in view of its reported good performance, the coal consumption being well under 2 lb. per I.H.P. per hour, which, considering it is non-compound, is certainly a very fine performance.

No. 667.—*Potato Planter, Richmond Patent.* 2-row. Price 17*l.* 10*s.*—Exhibited by John Wallace & Sons, Ltd., Graham Square, Glasgow. The potatoes are fed into cups fitted on to an inclined moving chain. The under side of these cups is provided with a loose metal ring, and in the event of the potato sticking in the cup it is knocked out by the loose ring falling on to it on return upward motion of the chain.

No. 1127.—*Hot Air Engine and Pump complete.* Price 45*l.*—Exhibited by Merryweather & Sons, Ltd., Greenwich Road, London, S.E. Capacity 250 gallons per hour against a head of 40 ft. A hot-air engine of usual design is coupled to a bucket pump. Very convenient and economical plant for a steady supply of water, as it will burn any kind of combustible refuse.

No. 1114.—*Petrol-driven Fire Engine, "Hatfield."* Price 1,350*l.*—Capacity, 450 gallons per minute, 4-cylinder engine of 56 H.P., fitted with three speeds and reverse, speed up to 35 miles per hour. Will carry a full complement of men, and send with one jet a column of water 200 ft. high, or four jets 120 ft.

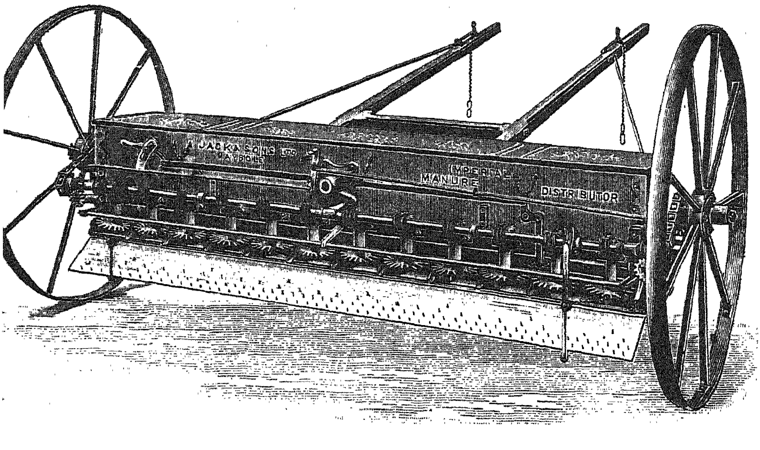

FIG. 4.—"Imperial" Manure Distributor.

No. 2234.—*Manure Distributor, "The Imperial,"* broadcast, 8 ft. wide, new finger wheel delivery. Price 16*l.* 15*s.*—Exhibited by Alexander-Jack & Sons, Ltd., Maybole, Ayrshire. The back plate is fitted with reciprocating motion so as to

bring the manure down to the feed wheels. This appears to be an improvement on other machines of this class.

No. 2610.—*Tank of Re-inforced Concrete.* Price for 10ft. diam., 3*l.* per ft. of depth.—Exhibited by William Hopkins, Montpellier Works, Cheltenham. A segment of such tank is exhibited, with the wrought iron mould plates in position. In light soil, where the construction of storage tanks is at once both necessary and difficult, this plan is certainly advantageous, more especially as the makers propose to hire out the moulds at a reasonable price, and the work can then be done by ordinary farm labour.

Stand 223.—*Butter Moulder.*—R. A. Lister & Co., Ltd., Dursley, Glos.—For dealing with butter or margarine in large quantities, delivering it in pieces moulded to shape and of a definite weight. A near approximation to an ordinary semi-plastic brick-making machine. The butter is placed in a container, where it is worked by a series of pug blades, and forced through a die on to a table, where it is cut into lengths by a wire frame worked by hand. The name, &c., of the dealer is impressed on the under side, by a suitably engraved roller, immediately the butter leaves the die.

Nos. 2954-2956.—*Millstones, Diamond Brand Composition.*—Exhibited by Wm. Garner & Sons, 72 Mark Lane, London, E.C. The well-known French burr stone has become difficult to procure. The above stones are made of the quarry chippings, ground up and mixed with a suitable binding cement, so as to nearly resemble the natural stone, than which they are somewhat lower in price and more equable in texture.

Stand 245.—The Agent-General for Queensland, 1 Victoria Street, Westminster, S.W. Of very considerable interest, exhibiting samples of all the products of the colony.

Nos. 3228-3235.—*Petrol Engines.*—Exhibited by R. A. Lister & Co. Ltd., Dursley, Glos. These engines are interesting, insomuch as the carburetter, instead of being provided with the almost universal "float feed," has the spirit pumped up by a continuous running pump, driven by the engine into a closed chamber, about level with the jet, and from whence the latter takes its supply, the surplus spirit returning by an overflow pipe to the reservoir.

Stand 315.—*Charlock and Thistle Cutter.*—Exhibited by W. N. Nicholson & Sons, Ltd., Trent Iron Works, Newark-on-Trent. On the points of the tines of an ordinary hay tedder are fixed long cutting blades, parallel to the axle, the sharp edge faced to rear. As the tedder revolves these blades cut off any high-growing stems close to ground. Very simple, and would appear not likely to get choked or out of order.

No. 3428.—*Petrol Motor Waggon.*—Exhibited by Leyland Motors, Ltd., Leyland, Lancashire. Three-ton petrol-driven lorries, 35 H.P. 4-cylinder engine, four speeds, and reverse. Price of Chassis 550*l.* Fitted with "live" axle, instead of the more usual side chains. No tongue rods are used, the strain being taken by the special casing of the universal shaft, which works in spherical joints, the universal joints being thus completely protected from grit. Steering by improved Ackerman device, a line drawn through the steering pivots, passing through the point of contact of wheel with ground, the steering being thus extremely certain and easy.

No. 4037.—*Air Compressor, Scott's Patent.* Manufactured by J. Petrie & Co., Ltd.—Exhibited by the Dudbridge Iron Works, Ltd., Stroud. The delivery valves, which are generally one of the most expensive parts of the upkeep, are of a new and apparently highly effective and simple design. A plate, forming the upper part of the compressing cylinder, is drilled full of recessed holes, in each of which is placed a steel ball, acting as a valve. The top of this plate is covered by another, similarly drilled; but the holes of the two are staggered, so that the balls cannot get thrown out of place. Ball valves are usually noisy, and wear rapidly, owing to the constant chattering of the ball in its seat. To overcome this the upper part of the hole is so little larger than the ball that the rush of air past keeps the ball off its seat until completion of the delivery stroke. The guaranteed efficiency is 95 per cent., and in tests it is reported that 97·4 per cent. has been obtained, together with the unusually low temperature of 210° F., which also is guaranteed.

Stand 365.—Crossley Bros., Ltd., Openshaw, Manchester. Among other interesting exhibits on the stand of this well-known firm may be mentioned No. 4038, *Producer Gas Engine of* 74 *B.H.P.* 160 revolutions, together with gas producer. Price 425*l.* for engine only. Fitted with compressed air starting gear, piston valve, water cooled exhaust, forced lubrication, &c.; a fine example of a most interesting type of motive power. Where constant power is required a producer gas engine is probably more economical than any other type of motive power. The writer had a large engine of this type under his direct supervision for a long time. Using Welsh anthracite coal (cobbles), the cost of fuel amounted to about one-tenth of a penny per H.P. per hour, and the cost of upkeep and attendance, unskilled, was very low. Messrs. Crossley's design and workmanship, of course, require no criticism.

Stand 377.—Fielding & Platt, Ltd., Atlas Iron Works, Gloucester. *A* 30-*B.H.P. Producer*, or *Suction Gas Engine*

and Producer, driving a set of three-throw pumps for the new Water Works at Wotton-under-Edge.—As this engine is intended for very long runs, special ring lubrication is fitted, together with low tension magneto ignition. The pump rams are 8 in. diam. by 9 in. stroke, and are designed to deliver 10,000 gallons per hour against a head of 300 ft.

Stand 417.—Shand, Mason & Co., 75 Upper Ground Street, Blackfriars Road, London, S.E. An exhibit of various Fire Engines and Appliances by this well-known firm. A very neat form of detachable hand-driven fan is shown, fitting into top of chimney, for use when specially quick steam raising is required.

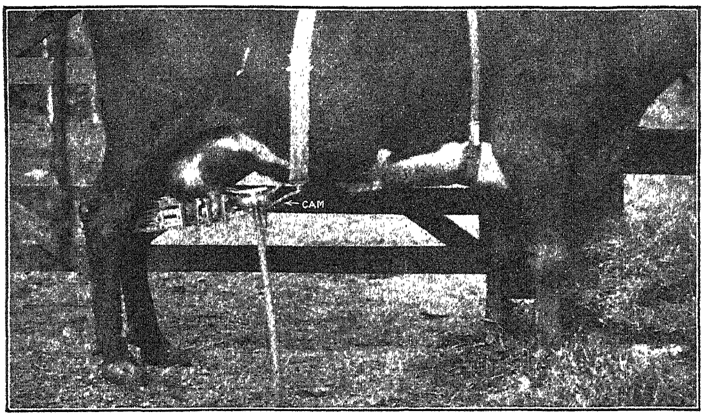

FIG. 5.—Loqvist Milking Machine.

Stand 437.—*The Loqvist Milking Machine.* Price each machine, 5*l.*; hand-driving gear for five cows, 5*l.*—Exhibited by L. de Wyttenbach, 20 High Holborn, London. Owing to an unfortunate misunderstanding this was not entered as a "New" implement, but it was shown in actual work. A large toothed wheel on the hand gear drove five pinions, which could be thrown in or out of gear independently. From each pinion a flexible shaft led to the cow to be dealt with. The milking machine, weight 5½ lb., is made entirely of magnalium, for the sake of lightness and strength. It consists of two pair of plates on edge, faced in the inner side with a thick piece of soft indiarubber. One pair measures 11 in. by 3½ in., the other 7½ in. by 3½ in. A screw adjustment is provided to regulate the distance apart of these plates. One of each pair is fixed, the other is given an irregular, reciprocating motion, by means of a rotating, heart-shaped, cam wheel, driven by the flexible

shaft. The machine is hung up beneath the cow by straps of webbing passing over the back and tail, the teats being placed between the indiarubber-faced plates. The action is as follows: at the commencement of the motion the upper edges of the plates approach each other, thus squeezing the upper portion of the teat, next the plates become parallel, and finally the lower edges come together, the whole action closely resembling the natural action of the calf. On the under side of the machine is hung a rectangular, open-topped tin tray, connected with which is a covered tin pan. The milk is discharged direct into the first tin, from whence it flows into the second. As the receiving tin fills it presses the machine up against the udder, tending thus to assist the delivery. About 100 squeezes per minute are given, the cow tested being stripped of milk in seven to eight minutes. Practically no milk was left, not more than a wine-glassful being extracted by hand from each teat after the machine was removed. A considerable pressure is given by the plates, as was easily tested by inserting a finger. The cow was quite indifferent, and stood quietly during the whole operation. In event of its being desired to leave one teat alone, all that is required is to slip off the indiarubber pads opposite to it, when, of course, the teat is not squeezed. It is to be noted that there are no pipes of any kind, which, in view of the great difficulty of keeping such properly clean inside and out and out of way and clear of being trodden on, is doubtless a decided improvement. It is to be hoped that next year the inventor will exhibit a more complete installation of this novel and exceedingly interesting machine. Owing to the very recent date of the invention it scarcely did itself justice at Gloucester.

I wish to express my thanks for the able co-operation of my co-judge, Mr. C. P. Hall, and for the courtesy and assistance rendered by the Stewards of the Implements, Messrs. R. M. Greaves and C. M. S. Pilkington, and the Society's Consulting Engineer, Mr. F. S. Courtney, M. Inst. C.E. It is only due to them to say that without the assistance, so ably and ungrudgingly given, it would have been impossible to have got through the work in the time available.

WM. CROSS, M.Inst.C.E.

Spreakfield Cottage,
Frensham, Farnham.

MILK AND BUTTER TESTS AT THE GLOUCESTER SHOW, 1909.

I.—MILK-YIELD TESTS.

THE prizes offered by the Society in these classes were on the same liberal scale as those given at Newcastle while, through the generosity of the Devon Cattle Breeders' Society, an extra class was provided for cows of that breed "yielding the largest quantity of milk, total solids and percentage of butter fat to be considered in making the awards."

These conditions differ from those governing the other milk-yield classes in that the "total solids" have to be taken into account, but seeing that as a rule the "solids other than fat" are fairly uniform, the fat percentages usually accounting for the differences shown in the "total solids," the records of the Devon Cows have been included in all the tables for the purpose of comparison with the yields of the other Dairy Breeds.

The actual difference in the "solids other than fat" between the two prize winners in the Devon class was only ·26.

The scale of points governing the milk-yield prizes was the same as at Newcastle, but the number of points necessary to be gained before a prize or commendation could be awarded was revised as below :—

	Cows 5 years and over.	Cows and Heifers under 5 years.
Shorthorn, Lincolnshire Red Shorthorn, and South Devon	60	55
Red-Poll, Ayrshire, Jersey, Guernsey, and Longhorn	55	50
Kerry and Dexter	45	40

The Devon awards were made without any reference to the disqualifying condition, as that breed is not mentioned in the classes. The cattle were stripped on the evening of Thursday, June 24, at 5 p.m., the milk of the next twenty-four hours being taken both for the Milk-yield and Butter Test trials. The milks, both in the morning and evening, after being weighed, were sampled by Dr. Voelcker for analysis.

In accordance with the recommendation in last year's report the trials were postponed until the third day of the Show, and it is satisfactory to point out that the average points gained this year seem to show that the change of date has been for the better.

The following Tables I. and II. give the full results of the Breed, and Special Milk-yield Classes.

Table I.—Milk-Yield Classes at Gloucester, 1909.

No. in Catalogue	Exhibitor	Name of cow	Date of birth	Date of last calf	No. of days in milk	Total milk yield in 24 hours (Lb.)	Total milk yield in 24 hours (oz.)	Fat percentage	Points: Milk	Points: Fat per cent. by 4	Points: Lactation	Points: Total	Awards
Class 97		*Shorthorns*		1909									
986	C. R. W. Adeane	Lady Crystal Bates	Oct. 3, 1900	May 15	40	45	12	3·00	45·75	12·00	Nil	57·75	—
990	W. M. Cazalet	Janette 45th	Feb. 17, 1900	Apr. 26	59	59	10	3·325	59·62	13·30	1·90	74·82	2nd Prize.
992	R. W. Hobbs & Sons	Primula 70th	Jan. 5, 1900	May 28	27	55	4	3·00	55·25	12·00	Nil	67·25	R.H.C.
994	W. Nisbet	Ewerby Sweet Duchess 2nd	May 3, 1902	Jan. 9	166	47	10	—	47·62	—	12·00	—	Not sampled in evening.
995	Lord Rothschild	Darlington Cranford 5th	Oct. 26, 1897	May 27	28	82	14	3·725	82·87	14·90	Nil	97·77	1st Prize.
996	Lord Rothschild	Gay Smartly	Mar. 20, 1902	June 3	21	45	10	2·925	45·62	11·70	Nil	57·32	Below Fat Standard.
997	Lord Rothschild	Gift 2nd	Aug. 4, 1901	Apr. 30	55	56	14	3·175	56·87	12·70	1·50	71·07	3rd Prize.
998	J. W. Sanders	Tricksey 16th	July 7, 1903	Jan. 25	150	28	12	3·30	28·75	13·20	11·00	52·95	—
1000	Marquis of Winchester	Amport Ursulina	Nov. 5, 1904	May 5	50	55	14	2·85	55·87	11·40	1·00	68·27	Below Fat Standard.
1001	Marquis of Winchester	Manor Fillpail	Nov. 20, 1897	Apr. 10	75	42	10	3·575	42·62	14·30	3·50	60·42	H.C.
1002	C. R. W. Adeane	Babraham Eva Bates	Sept. 9, 1905	May 19	36	47	6	3·925	47·37	15·70	Nil	63·07	H.C.
Class 105		*Lincolnshire Reds*											
1044	John Evens	Burton Cork 6th	Mar. 30, 1905	Apr. 7	78	47	2	3·375	47·12	13·50	3·80	64·42	3rd Prize.
1045	John Evens	Burton Fuchsia 3rd	1902	Apr. 13	72	63	4	4·275	63·25	17·10	3·20	83·55	1st Prize.
1046	John Evens	Burton Ruby 4th	Sept. 17, 1897	May 23	32	52	6	3·95	52·37	15·80	Nil	68·17	2nd Prize.
1048	F. Scorer	Bracebridge No. 3 B.	Sept. 28, 1903	Apr. 28	57	61	8	2·675	61·50	10·70	1·70	73·90	Below Fat Standard.
1050	F. B. Wilkinson	Donington Crawley	Oct. 1, 1900	Apr. 10	75	39	10	3·15	39·62	12·60	3·50	55·72	—
1052	J. G. Williams	Enderby Lass 4th	Sept. 17, 1901	Mar. 16	100	48	14	2·85	48·87	11·40	6·00	66·27	Below Fat Standard.
Class 123		*Devons*											
1212	M. J. Kidner	Dorothy Lass	Mar. 6, 1902	Mar. 26	29	28	6	3·55	28·37	14·20	Nil	47·57	2nd Prize.
1213	G. J. B. Chetwynd	Compton Lovely	Feb. 5, 1904	Apr. 27	58	38	8	4·10	38·50	16·40	1·80	56·70	1st Prize.
1214	G. J. B. Chetwynd	Compton Rose	Feb. 15, 1900	Apr. 11	74	29	8	1·45	29·50	5·80	3·40	38·70	Below Fat Standard.
1215	G. J. B. Chetwynd	Magnet	Nov. 12, 1901	Apr. 28	57	45	14	2·625	45·87	10·50	1·70	58·07	Below Fat Standard.
Class 129		*South Devons*											
1229	W. P. Vosper	Cowslip 5th	Feb. 28, 1901	Mar. 2	114	58	14	4·20	58·87	16·80	7·40	83·07	1st Prize.
1231	W. P. Vosper	Victoria	Oct. 8, 1902	Mar. 3	113	50	14	4·20	50·87	16·80	7·30	74·97	3rd Prize.
1232	W. & H. Whitley	Beauty 2nd	Sept. 2, 1901	Mar. 20	96	55	0	3·975	55·00	15·90	5·60	76·50	2nd Prize.
1233	W. & H. Whitley	Peeper	May 26, 1898	Feb. 1	143	50	8	3·50	50·50	14·00	10·30	74·80	R.H.C.
Class 134		*Longhorns*											
1261	W. H. Sale	Lady Panza	Sept. 8, 1902	Nov. 13, 1908	223	32	4	4·475	32·25	17·90	12·00	62·15	1st Prize.
1262	C. T. Scott	Taverner's Dark Pansy	Apr. 19, 1896	May 1	54	36	2	4·10	36·12	16·40	1·40	53·92	—
Class 151		*Red Polls*											
1343	K. M. Clark	Sudbourne Belle Dotty	May 1, 1901	Apr. 2	83	43	0	2·50	43·00	11·20	4·30	58·50	Below Fat Standard.
1344	K. M. Clark	Sudbourne Queen 1st	Sept. 3, 1904	June 1	23	55	2	3·325	55·12	13·30	Nil	68·42	1st Prize.
1346	Sir W. Corbet, Bt.	Desiree of Johnstown	Dec. 26, 1900	Mar. 17	99	40	8	3·475	40·50	13·90	5·90	60·30	2nd Prize.
1350	A. Carlyle Smith	Queen Mab	May 28, 1905	Apr. 10	75	35	0	2·35	35·00	9·40	3·50	47·90	Below Fat Standard.
Class 167		*Ayrshires*											
1436	J. Howie	Borrowmoss Lady Flora	March, 1898	Feb. 28	116	48	8	2·775	48·50	11·10	7·60	67·20	Below Fat Standard.
1437	A. W. & J. Kerr	Old Graitney Fairy Like	June, 1902	June 5	19	37	8	4·40	37·50	17·60	Nil	55·10	2nd Prize.
1442	W. Nisbet	Dalfibble Daisy Bell	Dec. 25, 1900	May 26	29	61	0	3·375	61·00	13·50	Nil	74·50	1st Prize.
Class 175		*Jerseys*											
1486	T. Beeby	Phyllis	Feb. 27, 1898	Jan. 26	149	35	4	5·45	35·25	21·80	10·90	67·95	H.C.
1487	H. B. Brandt	Delusion 3rd	Apr. 15, 1905	Mar. 19	97	20	10	4·15	20·62	16·60	5·70	42·92	—
1488	H. B. Brandt	Gatton	Nov. 29, 1904	Apr. 12	73	35	10	5·275	35·62	21·10	3·30	60·02	H.C.
1490	Earl Cadogan	Garantie 13th	July 12, 1903	Mar. 27	89	23	2	5·05	23·12	20·20	4·90	48·22	—
1491	Earl Cadogan	Jubilee May 2nd	Jan. 1, 1905	May 11	44	39	2	4·00	39·12	16·90	·40	55·52	H.C.
1492	W. M. Cazalet	Ermyntrude 2nd	June 3, 1905	Mar. 24	92	26	4	5·40	26·25	21·60	5·20	53·05	H.C.
1501	Lady de Rothschild	Lady Phyllis	Mar. 12, 1902	Mar. 30	86	46	4	5·825	46·25	23·30	4·60	74·15	1st Prize.
1498	Jersey de Knoop	Oakland's Beauty	Mar. 10, 1899	May 11	44	43	8	4·075	43·50	16·30	·40	60·20	H.C.
1505	Ladies E. & D. Hope	Tiber 2nd	Feb. 6, 1897	Apr. 11	74	34	12	4·625	34·75	18·50	3·40	56·65	H.C.

Table I.—MILK-YIELD CLASSES at GLOUCESTER, 1909—*continued.*

No. in Catalogue	Exhibitor	Name of cow	Date of birth	Date of last calf	No. of days in milk	Total milk yield in 24 hours (Lb.)	Total milk yield in 24 hours (oz.)	Fat per-cent-age	Points: Milk	Points: Fat per cent. by 4	Points: Lacta-tion	Points: Total	Awards
Class 175		*Jerseys*—continued.		1909		Lb.	oz.						
1508	Mrs. McIntosh	Bright Lustine	Jan. 21, 1903	Apr. 5	80	35	2	4·45	35·12	17·80	4·00	56·92	H.C.
1512	A. Pocock	Black Lily	Apr. 4, 1904	Apr. 19	66	35	10	4·70	35·62	18·80	2·60	57·02	H.C.
1513	A. Pocock	Freegrove Lily	Jan. 5, 1905	Apr. 29	56	47	4	4·60	47·25	18·40	1·60	67·25	H.C.
1515	Lord Rothschild	Kenta	Mar. 6, 1905	Feb. 10	134	39	2	4·45	39·12	17·80	9·40	66·32	H.C.
1517	J. H. Smith-Barry	Caprice	July 28, 1905	Dec. 16, 1908	190	42	8	4·60	42·50	18·40	12·00	72·90	2nd Prize.
1518	J. H. Smith-Barry	Lydia Languish	Dec. 15, 1903	Feb. 28	116	42	6	3·575	42·37	14·30	7·60	64·27	H.C.
1519	J. H. Smith-Barry	Post Obit	Mar. 23, 1904	May 27	28	53	2	4·125	53·12	16·50	Nil	69·62	R.H.C.
1522	R. Bruce Ward	Lovely Venus	Sept. 24, 1902	May 1	54	56	6	3·10	56·37	12·40	1·40	70·17	3rd Prize.
1524	R. Bruce Ward	Violin's Lavanja	Nov. 30, 1905	Mar. 27	89	39	14	5·05	39·87	20·20	4·90	64·97	H.C.
1526	Jersey de Knoop	Seamless	Aug. 25, 1906	May 5	50	25	4	5·30	25·25	21·20	1·00	47·45	—
1537	J. H. Smith-Barry	Flandre's Girl	Jan. 9, 1906	Mar. 23	93	35	0	3·45	35·00	13·80	5·30	54·10	H.C.
1538	Major Tennant	Aconite	Feb. 22, 1906	Apr. 4	81	31	4	5·05	31·25	20·20	4·10	55·55	H.C.
Class 181		*Guernseys*											
1597	Mrs. Bainbridge	Elfordleigh Judy	Mar. 7, 1903	May 2	53	46	14	4·25	46·87	17·00	1·30	65·17	3rd Prize.
1598	W. J. Empson	Felois	June 18, 1897	June 6	18	41	10	3·50	41·62	14·00	Nil	55·62	H.C.
1599	W. J. Empson	Merton Beauty of the Villiage	Jan. 9, 1902	Jan. 27	148	36	2	4·775	36·12	19·10	10·80	66·02	2nd Prize.
1601	Sir E. A. Hambro	Mrs. Dreyfus	Aug. 26, 1900	Mar. 8	108	31	4	5·475	31·25	21·90	6·80	59·95	H.C.
1603	Sir H. F. Lennard, Bt.	Lady 89	May 2, 1904	Apr. 24	61	43	8	3·775	43·50	15·10	2·10	60·70	H.C.
1605	F. Pratt-Barlow	Citron Blossom 25th	June 8, 1905	Apr. 21	64	38	0	3·80	38·00	15·20	2·40	55·60	H.C.
1607	Col. St. Aubyn	Golden Horn of Glynn	Nov. 4, 1900	Apr. 21	64	46	14	3·025	46·87	12·10	2·40	61·37	R.H.C.
1609	Lady Tichborne	Itchen Pearl	June 7, 1901	Mar. 8	108	47	4	4·95	47·25	19·80	6·80	73·85	1st Prize.
1610	Lady Tichborne	Itchen Pearl 2nd	Mar. 29, 1904	May 19	36	38	6	4·20	38·37	16·80	Nil	55·17	H.C.
Class 186		*Kerries*											
1639	Muriel Countess De la Warr	Buckhurst Gem	July 20, 1899	Apr. 28	57	41	10	3·85	41·62	15·40	1·70	58·72	1st Prize.
1641	Muriel Countess De la Warr	Raheny	Apr. 9, 1904	May 19	36	49	4	2·20	49·25	8·80	Nil	58·05	Below Fat Standard.
1642	Lady Greenall	Maple 4th of Carton	Mar. 3, 1899	Apr. 29	56	40	0	3·90	40·00	15·60	1·60	57·20	3rd Prize.
1643	Lady Greenall	Walton Bashful	1904	May 1	54	34	8	3·125	34·50	12·50	1·40	48·40	H.C.
1644	Duchess of Newcastle	Hardwick Jeanie	1897	Apr. 14	71	37	8	3·175	37·50	12·70	3·10	53·30	R.H.C.
1645	D. M. Rattray	Gort Drop	1903	Apr. 17	68	38	10	2·50	38·62	10·00	2·80	51·42	Below Fat Standard.
1646	Edmund Royds	Caythorpe Daisy	Apr. 21, 1904	Apr. 27	58	31	6	3·30	31·37	13·20	1·80	46·37	H.C.
1647	J. L. Tillotson	Gort Primrose	1901	Mar. 7	109	26	2	3·15	26·12	12·60	6·90	45·62	H.C.
1648	J. L. Tillotson	Morna 13th	July 2, 1905	May 6	49	24	12	3·025	24·75	12·10	·90	37·75	—
1650	T. Waite	Mangerton Mavourneen	1897	Apr. 17	68	41	14	3·40	41·87	13·60	2·80	58·27	2nd Prize.
1654	R. Tait Robertson	Daisy 3rd of Carton	Jan. 16, 1905	Mar. 28	88	31	4	3·60	31·25	14·40	4·80	50·45	H.C.
1655	R. Tait Robertson	Orchid 7th of Carton	Jan. 11, 1906	Apr. 23	62	25	10	2·15	25·62	8·60	2·20	36·42	Below Fat Standard.
1656	Edmund Royds	Caythorpe Blossom 2nd	Apr. 13, 1906	Jan. 10	165	23	4	4·25	23·25	17·00	12·00	52·25	H.C.
Class 191		*Dexters*											
1687	H.M. The King	Waterville Judy	1902	May 10	45	40	10	4·10	40·62	16·40	·50	57·52	2nd Prize.
1689	B. de Bertodano	Cowbridge Dainty Dish	March, 1902	May 25	30	30	4	3·775	30·25	15·10	Nil	45·35	H.C.
1690	B. de Bertodano	Cowbridge Darling	March, 1904	May 20	35	31	4	4·375	31·25	17·50	Nil	48·75	H.C.
1691	B. de Bertodano	La Mancha Sweet Nell	1901	May 27	28	42	2	4·275	42·12	17·10	Nil	59·22	1st Prize.
1693	H. M. Gibbs	Barrow Bee	1903	Apr. 28	57	32	0	4·325	32·00	17·30	1·70	51·00	R.H.C.
1694	H. M. Gibbs	Barrow Gunga	1901	Mar. 28	88	28	8	2·95	28·50	11·80	4·80	45·10	Below Fat Standard.
1696	James Lee	Direen Oonah	1905	Apr. 22	63	27	10	4·15	27·62	16·60	2·30	46·52	H.C.
1697	Hon. Mrs. C. Portman	La Mancha Hard to Find	Apr. 9, 1904	June 6	18	36	6	3·875	36·37	15·50	Nil	51·87	3rd Prize.
1698	D. M. Rattray	Gort Rose 2nd	Mar. 20, 1905	Apr. 21	64	28	14	3·275	28·87	13·10	2·40	44·37	—
1699	D. M. Rattray	Gort Winnie	1903	Apr. 17	68	26	4	2·95	26·25	11·80	2·80	40·85	Below Fat Standard.
1700½	J. Robertson	Gort Gold Cup	1903	May 25	30	28	0	3·825	28·00	15·30	Nil	43·30	—
1701	J. Robertson	Gort Sunbeam	1902	Mar. 27	89	25	6	3·675	25·37	14·70	4·90	44·97	—

Table II.—Class 192.—SPECIAL MILK-YIELD CLASS for COWS IN-MILK of any Age, Breed, or Cross.

No. in Catalogue	Exhibitor	Name of cow	Breed	Date of birth	Date of last calf	No. of days in milk	Total milk yield in 24 hours	Fat percentage	Points: Milk	Points: Fat per cent. by 4	Points: Lactation	Points: Total	Awards
					1909		Lb. oz.						
992	R. W. Hobbs & Sons	Primula 70th	Shorthorn	Jan. 5, 1900	May 28	27	55 4	3·00	55·25	12·00	Nil	67·25	H.C.
994	W. Nisbet	Ewerby Sweet Duchess 2nd	Shorthorn	May 3, 1902	Jan. 9	166	47 10	—	47·62	—	12·00	—	[morning Not sampled in
995	Lord Rothschild	Darlington Cranford 5th	Shorthorn	Oct. 26, 1897	May 27	28	82 14	3·725	82·87	14·90	Nil	97·77	1st Prize
1001	Marquis of Winchester	Manor Fillpail	Shorthorn	Nov. 20, 1897	Apr. 10	75	42 10	3·575	42·62	14·30	3·50	60·42	H.C.
1044	J. Evens	Burton Cork 6th	Lincoln Red	Mar. 30, 1905	Apr. 7	78	47 2	3·375	47·12	13·50	3·80	64·42	H.C.
1045	J. Evens	Burton Fuchsia 3rd	Lincoln Red	1902	Apr. 13	72	63 4	4·275	63·25	17·10	3·20	83·55	3rd Prize
1046	J. Evens	Burton Ruby 4th	Lincoln Red	Sept. 17, 1897	May 23	32	52 6	3·95	52·37	15·80	Nil	68·17	H.C.
1053	J. G. Williams	Enderby Lass 4th	Lincoln Red	Sept. 17, 1901	Mar. 16	100	48 14	2·85	48·87	11·40	6·00	66·27	Below Fat Standard
1214	G. J. B. Chetwynd	Compton Lovely	Devon	Feb. 5, 1904	Apr. 27	58	38 8	4·10	38·50	13·44	1·80	56·70	—
1215	G. J. B. Chetwynd	Compton Rose	Devon	Feb. 15, 1900	Apr. 11	74	29 8	1·45	29·50	5·80	3·40	38·70	Below Fat Standard
1215	G. J. B. Chetwynd	Magnet	Devon	Nov. 12, 1901	Apr. 28	57	45 14	2·625	45·87	10·50	1·70	58·07	Below Fat Standard
1229	W. P. Vosper	Cowslip 5th	S'th Devon	Feb. 28, 1901	Mar. 2	114	58 14	4·20	58·87	16·80	7·40	83·07	R.H.C.
1231	W. P. Vosper	Victoria	S'th Devon	Oct. 8, 1902	Mar. 3	113	50 14	4·20	50·87	16·80	7·30	74·97	H.C.
1232	W. & H. Whitley	Beauty 2nd	S'th Devon	Sept. 2, 1901	Mar. 20	96	55 0	3·975	55·00	15·90	5·60	76·50	H.C.
1233	W. & H. Whitley	Peeper	S'th Devon	May 26, 1898	Feb. 1	143	50 8	3·50	50·50	14·00	10·30	74·80	H.C.
1343	K. M. Clark	Sudbourne Belle Dotty	Red Poll	May 1, 1901	Apr. 2	83	43 0	2·80	43·00	11·20	4·30	58·50	Below Fat Standard
1344	K. M. Clark	Sudbourne Queen 1st	Red Poll	Sept. 3, 1904	June 1	23	55 2	3·325	55·12	13·30	Nil	68·42	H.C.
1346	Sir W. Corbet, Bart.	Desiree of Johnstown	Red Poll	Dec. 26, 1900	Mar. 17	99	40 8	3·475	40·50	13·90	5·90	60·30	H.C.
1442	W. Nisbet	Dalfibble Daisy Bell	Ayrshire	Dec. 25, 1900	May 26	29	61 0	3·375	61·00	13·50	Nil	74·50	H.C.
1486	T. Beeby	Phyllis	Jersey	Feb. 27, 1898	Jan. 26	149	35 4	5·45	35·25	21·80	10·90	67·95	H.C.
1490	Earl Cadogan	Garantie 13th	Jersey	July 12, 1903	Mar. 27	89	23 2	5·05	23·12	20·20	4·90	48·22	—
1491	Earl Cadogan	Jubilee May 2nd	Jersey	Jan. 1, 1905	May 11	44	39 2	4·00	39·12	16·00	·40	55·52	H.C.
1492	W. M. Cazalet	Ermyntrude 2nd	Jersey	June 3, 1905	Mar. 24	92	26 4	5·40	26·25	21·60	5·20	53·05	H.C.
1501	Lady de Rothschild	Lady Phyllis	Jersey	Mar. 12, 1902	Mar. 30	86	46 4	5·825	46·25	23·30	4·60	74·15	H.C.
1508	Mrs. McIntosh	Bright Lustine	Jersey	Jan. 21, 1903	Apr. 5	80	35 2	4·45	35·12	17·80	4·00	56·92	H.C.
1512	A. Pocock	Black Lily	Jersey	Apr. 4, 1904	Apr. 19	66	35 10	4·70	35·62	18·80	2·60	57·02	H.C.
1517	J. H. Smith-Barry	Caprice	Jersey	July 28, 1905	Dec. 16, '08	190	42 8	4·60	42·50	18·40	12·00	72·90	H.C.
1518	J. H. Smith-Barry	Lydia Languish	Jersey	Dec. 15, 1903	Feb. 28	116	42 6	3·575	42·37	14·30	7·60	64·27	H.C.
1519	J. H. Smith-Barry	Post Obit	Jersey	Mar. 23, 1904	May 27	28	53 2	4·125	53·12	16·50	Nil	69·62	H.C.
1537	J. H. Smith-Barry	Flandre's Girl	Jersey	Jan. 9, 1906	Mar. 23	93	35 0	3·45	35·00	13·80	5·30	54·10	H.C.
1538	Major Tennant	Aconite	Jersey	Feb. 22, 1906	Apr. 4	81	31 4	5·05	31·25	20·20	4·10	55·55	H.C.
1601	Sir E. A. Hambro	Mrs. Dreyfus	Guernsey	Aug. 26, 1900	Mar. 8	108	31 4	5·475	31·25	21·90	6·80	59·95	H.C.
1728	J. Evens	Burton Tozzle	Shorthorn	1901	May 22	35	71 4	3·30	71·25	13·20	Nil	84·45	2nd Prize [morning
1731	J. M. F. Fuller	Golden Unit	Jersey	Feb. 14, 1902	Dec. 12, '08	194	33 0	4·70	33·00	—	12·00	—	Not sampled in
1732	R. W. Hobbs & Sons	Lemhill 8th	Shorthorn	Sept. 12, 1902	Apr. 8	77	53 8	2·00	53·50	8·00	3·70	—	Not sampled in
1736	F. B. Wilkinson	Peggy	Lincoln Red	1900	May 14	41	58 4	3·325	58·25	13·30	·10	71·65	H.C. [morning

Table III. gives the number of the cattle which competed at Gloucester and at the three previous shows, from which it will be seen that the numbers this year show a considerable increase.

TABLE III.

Breed	Derby, 1906	Lincoln, 1907	Newcastle, 1908	Gloucester, 1909
Shorthorn	10	12	8	13
Lincolnshire Red Shorthorn .	4	8	4	7
Devon	—	—	—	4
South Devon	2	2	3	4
Longhorn	1	2	4	2
Red Poll	6	6	5	4
Ayrshire	1	4	3	3
Jersey	18	9	17	22
Guernsey	8	6	5	9
Kerry	5	5	8	13
Dexter	8	10	7	12
Crossbred	—	1	1	—
Total	63	65	65	93

Tables IV. and VI. give the averages of the cows both in the Breed and Special classes.

TABLE IV.—*Averages of Cattle entered in the Breed Milk-yield Classes.*

No. of cows competing	Breed	Days in milk	Milk		Fat per cent.	Points			
						Milk	Fat	Lactation	Total
			Lb.	oz.					
10	Shorthorn .	54	52	1	3·28	52·06	13·12	1·40	66·58
6	Lincoln. Red do.	69	52	2	3·37	52·12	13·48	2·90	68·50
4	Devon . .	69	35	9	2·93	35·56	11·72	2·90	50·18
4	South Devon .	116	53	13	3·96	53·81	15·84	7·60	77·25
2	Longhorn .	138	34	3	4·28	34·18	17·12	9·80	61·10
4	Red Poll . .	70	43	$6\frac{1}{2}$	2·98	43·40	11·92	3·00	58·30
3	Ayrshire . .	54	49	0	3·51	49·00	14·04	1·40	64·44
21	Jersey . .	85	37	$7\frac{19}{21}$	4·58	37·49	18·32	4·50	60·31
9	Guernsey . .	73	41	$1\frac{5}{9}$	4·19	41·10	16·76	3·30	61·16
13	Kerry . .	72	34	$4\frac{8}{13}$	3·20	34·29	12·80	3·20	50·29
12	Dexter . .	51	31	7	3·79	31·43	15·16	1·10	47·69

Table V.—Results of Butter Tests at Gloucester, 1909.

Class 193 A.—Cows in-milk, of any age, breed or cross, exceeding 900 lb. live weight. 29 Entries.

No. in Catalogue	Exhibitor	Name of cow	Breed	Live weight	Date of birth	Date of last calf	No. of days in milk	Milk yield in 48 hours	Butter yield	[1]Ratio, viz. lb. milk to lb. butter	Colour and quality of butter: Colour	Colour and quality of butter: Quality	No. of points for butter	No. of points for lactation	Total No. of points	Awards	Churning Table: Time: Began	Churning Table: Time: Finished	Churning Table: Time: Duration (minutes)	Churning Table: Temperature, ° F.: Dairy	Churning Table: Temperature, ° F.: Cream and churn	Churning Table: Temperature, ° F.: Buttermilk
				Lb.		1909		Lb. oz.	Lb. oz.													
992	R. W. Hobbs & Sons	Primula 70th	Shorthorn	1568	Jan. 5, '00	May 28	27	55 4	1 5¼	41·60	Fair	Fair	21·25	Nil	21·25	...	11 5	11 24	19	55	52	53
994	W. Nisbet	Ewerby Sweet Duchess 2nd	Shorthorn	1232	May 3, '02	Jan. 9	166	47 10	1 5	36·28	Fair	Fair	21·00	12·00	33·00	H. C.	4 5	4 48	43	55	52	54
995	Lord Rothschild	Darlington Cranford 5th	Shorthorn	1484	Oct. 26, '97	May 27	28	82 14	3 2	26·52	Pale	Poor	50·00	Nil	50·00	2nd Prize and 2nd S.P.	11 11	11 29	18	55	52	54
1001	The Marquis of Winchester	Manor Fillpail	Shorthorn	1358	Nov. 20, '97	April 10	75	42 10	1 9¼	26·74	Good	Good	25·25	3·50	28·75	...	10 10	10 40	30	54	52	52
1044	J. Evens	Burton Cork 6th	L'nc'n Red	1260	Mar. 30, '05	April 7	78	47 2	1 9¾	29·28	Fair	Good	25·75	3·80	29·55	H. C.	2 59	3 32	33	55	52	54
1045	J. Evens	Burton Fuchsia 3rd	L'nc'n Red	1358	1902	April 13	72	63 4	2 13¼	22·36	Excellent	Excellent	45·25	3·20	48·45	3rd Prize, and 3rd S.P.	2 21	2 58	37	55	52	52
1046	J. Evens	Burton Ruby 4th	L'nc'n Red	1400	Sept. 17, '97	May 23	32	52 6	2 0¾	25·58	Fair	Good	32·75	Nil	32·75	H. C.	12 22	1 10	48	55	52	54
1048	F. Scorer	Bracebridge No. 3 B	L'nc'n Red	1568	Sept. 28, '03	April 28	57	61 8	1 11¾	35·45	Fair	Good	27·75	1·70	29·45	...	12 16	12 31	15	55	52	53
1052	J. G. Williams	Enderby Lass 4th	L'nc'n Red	1456	Sept. 17, '01	March 16	100	48 14	1 7¼	33·63	Pale	Good	23·25	6·00	29.25	...	12 10	1 0	50	55	52	54
1213	G. J. B. Chetwynd	Compton Lovely	Devon	1141	Feb. 5, '04	April 27	58	38 8	1 9¼	24·39	Fair	Good	25·25	1·80	27·05	...	12 12	12 44	32	55	52	54
1214	G. J. B. Chetwynd	Compton Rose	Devon	1274	Feb. 15, '00	April 11	74	29 8	7	67·42	Fair	Good	7·00	3·40	10·40	...	2 19	3 21	62	55	52	—
1215	G. J. B. Chetwynd	Magnet	Devon	1150	Nov. 12, '01	April 28	57	45 14	1 2¾	39·14	Good	Good	18·75	1·70	20·45	...	11 47	12 20	33	55	52	53
1229	W. P. Vosper	Cowslip 5th	S. Devon	1792	Feb. 28, '01	March 2	114	58 14	2 8½	23·25	Excellent	Excellent	40·50	7·40	47·90	R.H.C., & R.N for S.P.	11 59	12 29	30	55	52	53
1231	W. P. Vosper	Victoria	S. Devon	1414	Oct. 8 '02	March 3	113	50 14	2 3¼	23·09	Good	Good	35·25	7·30	42·55	H. C.	11 24	12 40	76	55	52	57
1232	W. & H. Whitley	Beauty 2nd	S. Devon	1694	Sept. 2, '01	March 20	96	55 0	2 3¼	24·96	Excellent	Excellent	35·25	5·60	40·85	H. C.	12 2	12 37	35	55	52	51
1233	W. & H. Whitley	Peeper	S. Devon	1596	May 26, '98	Feb. 1	143	50 8	1 12½	28·35	Good	Good	28·50	10·30	38·80	H. C.	11 25	12 7	42	55	52	54
1343	K. M. Clark	Sudbourne Belle Dotty	Red Poll	1120	May 1, '01	April 2	83	43 0	1 1¼	39·88	Fair	Fair	17·25	4·30	21·55	...	11 18	11 59	41	55	52	53
1344	K. M. Clark	Sudbourne Queen 1st	Red Poll	1232	Sept. 3, '04	June 1	23	55 2	1 14½	28·91	Good	Good	30·50	Nil	30·50	H.C.	10 53	11 54	61	54	52	53
1346	Sir W. Corbet, Bart.	Desiree of Johnstown	Red Poll	1288	Dec. 26, '00	March 17	99	40 8	1 8¾	26·18	Fair	Fair	24·75	5·90	30·65	...	10 30	10 55	25	54	52	53
1442	W. Nisbet	Dalfibble Daisy Bell	Ayrshire	1012	Dec. 25, '00	May 26	29	61 0	2 1¾	28·91	Fair	Good	33·75	Nil	33·75	H.C.	10 26	11 41	75	54	52	53
1486	T. Beeby	Phyllis	Jersey	1054	Feb. 27, '98	Jan. 26	149	35 14	2 0¾	17·52	Excellent	Excellent	32·75	10·90	43·65	H.C. & E.J.C.S. Bronze Medal	10 22	11 55	33	54	52	54
1501	Lady de Rothschild	Lady Phyllis	Jersey	1082	Mar. 12, '02	Mar. 30	86	46 4	2 13¾	16·17	Good	Excellent	46·75	4·60	50·35	1st Prize, and 1st S.P., E.J.C.S. Gold Medal.	4 3	4 53	50	55	52	54
1599	W. J. Empson	Merton Beauty of the Villiage	Guernsey	1274	Jan. 9, '02	Jan. 27	148	36 2	1 12¼	20·46	Excellent	Excellent	28·25	10·80	39·05	H.C.	2 16	2 45	29	55	52	54
1603	Sir H. F. Leonard, Bart.	Lady No. 89	Guernsey	1120	May 2, '04	April 24	61	43 8	1 12¼	24·63	Excellent	Excellent	28·25	2·10	30·35	...	2 14	3 7	53	55	52	56
1606	F. Pratt-Barlow	Lady Flora 3rd	Guernsey	910	Mar. 25, '05	April 21	64	38 6	1 15	19·50	Good	Good	31·00	2·40	33·40	H.C.	2 9	3 25	76	55	52	54
1641	Muriel, Countess de la Warr	Raheny	Kerry	952	Apr. 9, '04	May 19	36	39 4	13¼	47·39	Pale	Good	13·25	Nil	13·25	...	2 11	2 39	28	55	52	53
1728	J. Evens	Burton Tozzle	Shorthorn	1428	1901	May 22	33	71 4	2 7	29·23	Fair	Good	39·00	Nil	39·00	H.C.	2 5	2 35	30	55	52	53
1731	J. M. F. Fuller	Golden Unit	Jersey	966	Feb. 14, '02	Dec. 12 '08	194	33 0	1 9¼	20·91	Fair	Good	25·25	12·00	37·25	H.C. & Certificate of Merit	10 15	12 5	110	54	52	53
1732	R. W. Hobbs & Sons	Lemhill 8th	Shorthorn	1316	Sept. 12, '02	April 8	77	53 8	12½	68·48	Pale	Poor	12·50	3·70	16·20	...	10 14	10 41	27	54	52	54

[1] The "Butter Ratio" represents the number of lb. of milk required to make 1 lb. of butter. Ten lb. of milk are reckoned as equal to an imperial gallon.

TABLE V.—RESULTS OF BUTTER TESTS AT GLOUCESTER, 1909—*continued.*

CLASS 193 B.—COWS IN-MILK, OF ANY AGE, BREED, OR CROSS NOT EXCEEDING 900 LB. LIVE WEIGHT. 16 ENTRIES.

No. in Catalogue	Exhibitor	Name of cow	Breed	Live weight	Date of birth	Date of last calf	No. of days in milk	Milk yield in 48 hours	Butter yield	[1] Ratio, viz., lb. milk to lb. butter	Colour and quality of butter: Colour	Colour and quality of butter: Quality	No. of points for butter	No. of points for lactation	Total No. of points	Awards	Churning Table: Time: Began	Churning Table: Time: Finished	Churning Table: Time: Duration (minutes)	Churning Table: Temperature, ° F.: Dairy	Churning Table: Temperature, ° F.: Cream and churn	Churning Table: Temperature, ° F.: Buttermilk
				Lb.		1900		Lb. oz.	Lb. oz.													
1489	J. Brutton	Easter Egg	Jersey	798	Apr. 25, '05	April 7	78	26 2	1 4½	20·39	Fair	Poor	20·50	3·80	24·30	...	10 17	11 52	95	54	52	57
1490	Earl Cadogan	Garantie 13th	Jersey	889	July 12, '03	Mar. 27	89	23 2	1 4¼	18·27	Fair	Fair	20·25	4·90	25·15	...	10 25	11 7	42	54	52	54
1491	Earl Cadogan	Jubilee May 2nd	Jersey	812	Jan. 1, '05	May 11	44	39 2	1 8	26·08	Fair	Fair	24·00	·40	24·40	...	10 25	10 44	19	54	52	53
1492	W. M. Cazalet	Ermyntrude 2nd	Jersey	819	June 3, '05	Mar. 24	92	26 4	1 8¼	17·31	Good	Good	24·25	5·20	29·45	...	10 17	11 31	74	54	52	54
1498	Jersey de Knoop	Oaklands Beauty	Jersey	812	Mar. 10, '99	May 11	44	43 8	1 14¾	22·63	Fair	Fair	30·75	·40	31·15	...	3 50	4 44	54	55	52	54
1503	J. M. F. Fuller	Brown Fancy	Jersey	742	Feb. 10, '04	Apr. 24	61	31 8	1 13¼	17·23	Fair	Fair	29·25	2·10	31·35	...	3 45	4 30	45	55	52	52
1505	Ladies E. & D. Hope	Tiber 2nd	Jersey	847	Feb. 6, '97	Apr. 11	74	34 12	1 10¼	21·18	Good	Good	26·25	3·40	29·65	...	3 40	4 15	35	55	52	51
1508	Mrs. McIntosh	Bright Lustine	Jersey	770	Jan. 21, '03	Apr. 5	80	35 2	1 10	21·61	Fair	Good	26·00	4·00	30·00	...	3 40	4 9	29	55	52	56
1512	A. Pocock	Black Lily	Jersey	812	Apr. 4, '04	Apr. 19	66	35 10	1 11½	20·72	Fair	Good	27·50	2·60	30·10	...	3 25	4 12	47	53	52	54
1517	J. H. Smith-Barry	Caprice	Jersey	812	July 28, '05	Dec. 16/08	190	42 8	2 0¾	20·76	Excellent	Excellent	32·75	12·00	44·75	1st Prize & E.J.C.S. Silver Medal.	3 14	3 50	36	55	52	56
1518	J. H. Smith-Barry	Lydia Languish	Jersey	819	Dec. 15, '03	Feb. 28	116	42 6	1 9¼	26·85	Good	Good	25·25	7·60	32·85	...	3 7	3 40	33	55	52	54
1519	J. H. Smith-Barry	Post Obit	Jersey	868	Mar. 23, '04	May 27	28	53 2	2 4	23·61	Excellent	Excellent	36·00	Nil	36·00	2nd Prize	2 52	3 30	38	55	52	54
1537	J. H. Smith-Barry	Flandres Girl	Jersey	805	Jan. 9, '06	Mar. 23	93	35 0	1 3¾	28·35	Fair	Good	19·75	5·30	25·05	...	2 20	3 34	74	55	52	56
1538	Major Tennant	Aconite	Jersey	812	Feb. 22, '06	Apr. 4	81	31 4	1 11	18·51	Fair	Good	27·00	4·10	31·10	3rd Prize.	3 13	3 57	44	55	52	54
1639	Muriel, Countess de la Warr	Buckhurst Gem	Kerry	896	July 20, '99	Apr. 28	57	41 10	1 10¾	24·89	Fair	Good	26·75	1·70	28·45	...	2 15	2 45	30	55	52	54
1739	Jersey de Knoop	Muscotah	Jersey	812	Mar. 1, '04	Apr. 17	68	30 4	1 13	16·68	Good	Good	29·00	2·80	31·80	...	10 28	11 18	50	54	52	53

[1] The "Butter Ratio" represents the number of lb of milk required to make 1 lb. of butter. Ten lb. of milk are reckoned as equal to an imperial gallon.

TABLE VI.—*Averages of Cattle entered in the Special Milk-yield Classes.*

No. of cows competing	Breed	Days in milk	Milk	Fat per cent.	Points			
					Milk	Fat	Lactation	Total
			Lb. oz.					
4	Shorthorn .	40	63 0	3·40	63·00	13·60	Nil	76·60
5	Lincoln. Red do.	64	53 15⅗	3·55	53·97	14·20	2·40	70·57
3	Devon . .	63	37 15⅕	2·72	37·95	10·88	2·30	51·13
4	South Devon .	116	53 13	3·96	53·81	15·84	7·60	77·25
3	Red Poll . .	68	46 3⅕	3·20	46·20	12·80	2·80	61·80
1	Ayrshire . .	29	61 0	3·375	61·00	13·50	Nil	74·50
12	Jersey . .	92	37 1⅓	4·63	37·08	18·52	5·20	60·80
1	Guernsey . .	108	31 4	5·475	31·25	21·90	6·80	59·95

NOTE.—The yields of Milk and particulars of one Shorthorn in Table IV., and of one Shorthorn and one Jersey in Table V. are not included in the figures given in these Tables, as in each case the herdsman omitted at one of the milkings to take the milk to Dr. Voelcker for analysis.

The following fourteen animals gave milk deficient in fat and were disqualified :—

2 Shorthorns	out of 11	sampled
2 Lincolnshire Red Shorthorns	" 7	"
2 Devons	" 4	
2 Red Polls	" 4	"
1 Ayrshire	" 3	"
3 Kerries	" 13	"
2 Dexters	" 12	"

II.—BUTTER TESTS (CLASS 193, A & B).

Forty-five cows competed in these classes at Gloucester, 29 of them being in the heavy and 16 in the light weight class.

The trials were carried out under similar conditions and with the same scale of points as in previous years, the cattle being stripped on the evening of Wednesday, June 23, at 5 p.m., the milk of the next 24 hours being used for the test.

The table on pp. 226 and 227 gives the full results of the trial.

Table VII. gives the number of cattle competing under their respective breeds, with the corresponding numbers at the Shows held at Derby, Lincoln, and Newcastle.

TABLE VII.

Breed	Derby, 1906	Lincoln, 1907	Newcastle, 1908	Gloucester, 1909
Shorthorn	2	4	3	6
Lincolnshire Red Shorthorn .	2	8	3	5
Devon	—	—	—	3
South Devon	2	2	3	4
Red Poll	—	1	—	3
Ayrshire	—	—	1	1
Jersey	17	14	15	18
Guernsey	—	4	1	3
Longhorn	—	1	—	—
Kerry	—	—	—	2
Crossbred	—	1	—	—
Total	23	35	26	45

The prizes were awarded as follows :—

CLASS 193 A.—COWS EXCEEDING 900 LB. LIVE WEIGHT.

1st Prize and 1st Special Prize	Lady de Rothschild's "Lady Phyllis"	Jersey.
2nd Prize and 2nd Special Prize	Lord Rothschild's "Darlington Cranford 5th"	Shorthorn.
3rd Prize and 3rd Special Prize	Mr. J. Evens' "Burton Fuchsia 3rd"	Lincoln. Red do.

CLASS 193 B.—COWS 900 LB. LIVE WEIGHT AND UNDER.

1st Prize	Mr. J. H. Smith-Barry's "Caprice"	Jersey.
2nd Prize	Mr. J. H. Smith-Barry's "Post Obit"	Jersey.
3rd Prize	Major Tennant's "Aconite"	Jersey.

The English Jersey Cattle Society's Medals (limited to Jersey Cows) were won as under :—

Gold Medal	Lady de Rothschild's "Lady Phyllis."
Silver Medal	Mr. J. H. Smith-Barry's "Caprice."
Bronze Medal	Mr. T. Beeby's "Phyllis."

Twenty-one cows out of the 45 tested received prizes or commendation cards, which does not compare favourably with other years. The wet cold week of the Show may perhaps account for this.

TABLE VIII.—*Averages of Cattle tested in the Butter Test Classes*

No. of cows competing	Breed	Live weight	Days in milk	Milk	Butter	Ratio	Points
		Lb.		Lb. oz.	Lb. oz.	Lb.	
6	Shorthorn . .	1397	67	58 $13\frac{2}{3}$	1 $12\frac{1}{6}$	33·43	31·36
5	Lincoln. Red do.	1408	67	54 10	1 $14\frac{19}{20}$	28·23	33·89
3	Devon . .	1188	63	37 $15\frac{1}{3}$	1 1	35·72	19·30
4	South Devon .	1624	116	53 13	2 $2\frac{7}{8}$	24·65	42·52
3	Red Poll . .	1213	68	46 $3\frac{1}{3}$	1 $8\frac{1}{6}$	30·59	27·56
1	Ayrshire . .	1012	29	61 0	2 $1\frac{3}{4}$	28·91	33·75
18	Jersey . .	851	90	35 $12\frac{5}{9}$	1 $11\frac{65}{72}$	20·50	32·68
3	Guernsey . .	1101	91	39 $5\frac{1}{3}$	1 $13\frac{1}{6}$	21·57	34·26
2	Kerry . .	924	46	40 7	1 4	32·35	20·85

TABLE IX.—*Average points won by the Cattle at Derby, Lincoln, Newcastle, and Gloucester, with the number of cattle competing at each Show.*

Breed	Derby		Lincoln		Newcastle		Gloucester	
	No. of Cows	Points	No. of Cows	Points	No. of Cows	Points	No. of Cows	Points
Shorthorn . .	2	37·77	4	31·70	3	46·76	6	31·36
Lincolnshire Red do.	2	38·45	8	31·06	3	36·85	5	33·89
Devon . . .	—	—	—	—	—	—	3	19·30
South Devon . .	2	41·40	2	37·75	3	29·38	4	42·52
Red Poll . . .	—	—	1	31·65	—	—	3	27·56
Ayrshire . . .	—	—	—	—	1	39·45	1	33·75
Jersey . . .	17	37·95	14	36·61	15	35·61	18	32·68
Guernsey . .	2	29·25	4	33·45	1	38·25	3	34·26
Longhorn . .	—	—	1	33·35	—	—	—	—
Kerry . . .	—	—	—	—	—	—	2	20·85

TABLE X.—*Average Butter Ratio figures or number of pounds of Milk taken to make 1 lb. of Butter under their respective breeds and headings at Derby, Lincoln, Newcastle, and Gloucester, and the average number of cows and butter ratio figures at the four Shows.*

Breed	Derby	Lincoln	Newcastle	Gloucester	The Four Shows	
					No. of Cows	Butter ratio
	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.
Shorthorn . .	20·53	30·94	24·94	33·43	15	28·82
Lincoln. Red do. .	28·80	29·24	22·30	28·23	18	27·75
Devon . . .	—	—	—	35·72	3	35·72
South Devon .	26·32	25·79	29·10	24·65	11	26·37
Red Poll . .	—	31·65	—	30·59	4	28·58
Ayrshire . .	—	—	28·69	28·91	2	28·80
Jersey . . .	19·47	19·38	19·69	20·50	64	19·82
Guernsey . .	20·28	22·35	19·89	21·57	10	21·45
Longhorn . .	—	33·35	—	—	1	33·35
Kerry . . .	—	—	—	32·35	2	32·35

III.—EXPERIMENTS IN THE DAIRY.

EXPERIMENT NO. I.

The Sampling of Milk.

To take an accurate and so "fair" sample of milk is not an easy matter. Cream rises very quickly to the surface, and when once risen, will not mix again with the milk unless the milk is heated up to 101° F., the blood heat of the cow.

Passing fresh milk over a refrigerator undoubtedly retards the rising of the cream, but not sufficiently to enable an accurate sample of the milk to be taken either by dipping or by drawing off through a tap—the usual methods practised in the retail milk trade.

The fact that "by the law of nature cream tends to settle at the top" has been recognised in the Superior Courts, and a tradesman selling milk without mixing the same and without disclosing the condition to a purchaser has been held liable to conviction under the Food and Drugs' Act, 1875 (Dyer v. Gower, 1 Q.B. 220).

To demonstrate the difficulty of taking a correct sample from a churn of milk, bearing in mind the decision in this case, and the methods adopted by the Inspectors under the Act when obtaining samples for analysis, the following experiment was undertaken.

A churn was specially labelled for the milk of a particular breed of cattle. As these milks were brought into the dairy they were poured into the churn, the time occupied in filling the churn being about thirty minutes.

For the special purpose of taking correct samples of milk, a glass tube 3 ft. 8 in. long, ¾ in. diameter, with one end tapered to ¼ in., and graded to take up to 8 oz. of milk, was sent to me from Mr. Cooper's laboratory at Watford. This tube was let down so slowly into the churn of milk that the milk inside the tube was kept level with the milk in the churn until the bottom of the churn was reached, when by closing the top of the tube with the thumb, a column of milk representing exactly the milk in the churn was abstracted.

This was emptied into a bottle specially labelled, and put on one side for analysis.

To take samples of milk at different depths in the churn the top of the tube was closed with the thumb until the particular depth was reached, when by admitting the air a sample of the milk at the depth selected was obtained.

In this way the following three samples were taken from the milk (*a*) at the top; (*b*) the middle; and (*c*) the bottom of the churn.

Each sample was put in a special bottle and labelled. The four lots of milk were next heated up to 101° F., and were tested for fat by the Gerber process.

The fat readings being as follows :—

	Per cent.
The whole of the milk in the churn	3·5 fat
Milk from top of churn	3·85 "
Milk from the middle	3·5 "
Milk from the bottom	3·1 "

The average of the last sample comes out at 3·483, or ·017 below the sample of the whole of the milk, showing that the analyses were fairly correct.

The milk from which these samples were taken was very good in quality, had it only averaged 3 per cent. fat the sample from the bottom of the churn would probably have only shown 2·6 or 2·7 per cent. fat.

From this experiment it will be seen that a retailer of milk is placed in a very difficult position when selling milk from a churn, whether he draws the milk from the bottom of the churn by a tap, or ladles it out from the top, as in the one case the last customer will have the best milk, and in the other the first will get the advantage.

In both cases, however, some customers will get milk of poor quality if the milk averages only 3 per cent. fat.

By dipping from the top or using a plunger the milk can undoubtedly be mixed better, and the chances of a prosecution

are minimised, but the objection to both these methods is that the bacteria present in the air of the dusty streets in a town, may find their way into the milk and do untold harm.

On the whole, therefore, the better course for a retailer of milk to pursue is to draw off the milk by a tap from the bottom of the churn, disclosing to the customer the natural tendency of cream to rise to the top of the milk, at the same time explaining the risk of introducing dirt into the milk if taken out of the churn by dipping.

In this way the retailer will avoid the risk of a prosecution, but at the same time he will run the risk of losing his customers.

If the position of the dairyman is difficult, much more so is that of the Inspector.

To satisfy himself that the milk in the churn is up to standard, when a disclosure as mentioned above is made, the Inspector should be prepared to take a correct sample, and this, it is submitted, can only be done by using a sampling tube.

If, on the other hand, the Inspector in such cases does not take a sample, a dishonest tradesman will soon take advantage of him.

The question is a difficult one both for the Inspectors and the honest tradesman, both of whom would desire that the milk supplied to the public should be pure and up to the standard.

In my opinion, the methods of sampling are not reliable, but at the same time I do not see how they can be improved, as long as the retail milk trade is carried on as at present.

The true solution of the difficulty, in my opinion, is to be found in the comparatively new, though much better, system of selling milk in bottles.

Experiment No. II.

The Colouring of Milk and Butter.

Experiments on the same lines as those undertaken at the Lincoln and Newcastle Shows (*vide* reports R.A.S.E. Journal, Vol. 68, p. 150, and 69, p. 201) were carried out in the Dairy at Gloucester during two days of the week, and were followed with similar results.

Four samples of milk were handed to the audience for inspection :

1. Jersey milk.
2. White milk from another breed.
3. Separated milk coloured, so as to be deeper in colour than the Jersey milk.
4. Separated milk uncoloured.

On every occasion the coloured separated milk received the largest number of votes.

Coloured Butter and Margarine.

Two lots of butter were selected, one made from Jersey milk, the other from white milk.

The latter was divided into two portions, one lot being left untouched, the other coloured to resemble the Jersey.

The Jersey butter was also divided, one lot being shown in its natural condition, to the other was added 25 per cent. of margarine.

The four samples were as follow :—

1. Pale butter (pure).
2. Jersey butter (pure).
3. Pale butter (coloured).
4. Margarine (25 per cent. margarine, 75 per cent. Jersey butter).

On every occasion that these samples were submitted to the public, the margarine received the greatest number of votes, which is the more surprising, as plenty of time was allowed for examination of all the samples.

But for the colouring matter in the margarine, there is little doubt that the mistake would not have been made. It is obvious, therefore, that if a reliable method for ascertaining the addition of colour to any substance could be found, it would be of the greatest advantage.

Having heard that an instrument called a "Tintometer" enabled colours to be analysed with accuracy, I communicated with the inventor, Mr. J. W. Lovibond, a short time before the Show, and as a result Mr. Lovibond and his daughter brought down to Gloucester on Saturday, June 19, a Tintometer, complete with the necessary coloured glasses, which he was kind enough to leave with me for the rest of the show.

Before their departure on Saturday, however, Mr. and Miss Lovibond were able to demonstrate that it was a comparatively easy matter to ascertain the exact combination of "dominant" colours—red, yellow, and blue—necessary to match a particular shade of colour in either a sample of butter or milk, and from the figures on the coloured glasses used in the Tintometer, which were graded on the basis of equivalent colour value, to calculate the percentage of black (neutral tint, the combination of the three dominant colours in equal proportions) to either orange or yellow, or when only the red and yellow coloured glasses were used, the percentage of orange to yellow.

The following experiment will perhaps make this clear: A sample of Jersey butter very deep in colour was compared with (*a*) a sample of ordinary shop butter and (*b*) a sample of margarine, the colours used in this instance being red and yellow only.

The results as disclosed by the Tintometer are as below :—

	Glasses used		Colours developed		Percentage of Orange to Yellow
	Red	Yellow	Orange	Yellow	
Jersey Butter . .	2·4	6·2	2·4	3·8	63·1
Shop Butter . .	2·4	5·6	2·4	3·2	75·0
Margarine . .	2·5	5·8	2·5	3·3	75·7

Taking the first lot, 2·4 of red when combined with 2·4 of yellow developes 2·4 orange. Deducting the 2·4 yellow which, combined with the 2·4 red made the 2·4 orange, from the original 6·2 yellow, 3·8 is left as the residue of the yellow colour.

The percentage of orange to yellow in the Jersey butter therefore works out at 63·1.

To the ordinary observer the Jersey butter appeared the deeper in colour, but the Tintometer showed that the percentage of orange in the genuine butter was less than in the margarine, and also that the shop butter was evidently coloured with similar material to that in the margarine.

To those who are familiar with the appearance of annato and other butter colouring preparations, this revelation will not come as a surprise.

Subsequently to this, samples of butter made in the dairy at Gloucester from the milks of certain breeds of cattle were sent to Mr. Lovibond for examination. These were examined by him with the three dominant coloured glasses, red, yellow, and blue, and the developed coloured measurements and percentages are shown in the following table.

COLOUR MEASUREMENTS OF BUTTER.

Breed	Colours Developed			Percentage of Black to Orange	Percentage of Black to Yellow
	Black	Orange	Yellow		
Shorthorn . .	·08	·98	1·03	7·54	7·08
Lincoln. Red do. .	·035	1·14	1·5	2·97	2·27
Devon . . .	·025	1·13	1·45	2·16	1·07
South Devon . .	·013	1·05	1·56	1·22	·826
Ayrshire . .	·056	1·03	1·45	5·15	3·65
Longhorn . .	·04	1·14	1·21	3·39	3·2
Gloucester . .	·046	·9	1·45	4·86	·307
Jersey . . .	·045	1·33	2·13	3·27	2·99
Guernsey . .	·016	1·51	2·8	1·04	·56
Kerry . . .	·02	·89	1·2	2·18	1·64
Dexter . . .	·023	·79	·88	2·82	2·54
Shop Butter . .	·880	·73	2·35	54·65	2·72
Margarine . .	·440	·89	1·76	30·76	2·0

It will be noticed that the percentage of black to orange in the shop butter and margarine is very much in excess of that shown in the sample of pure butter.

For further information and illustrations on this subject the reader is referred to "Measurement of Light and Colour Sensation," by J. W. Lovibond, G. Gill and Sons, and "An Introduction to the Study of Colour Phenomena," by the same author, now published by the Tintometer Company.

Experiment No. III.

Wensleydale Cheese.

Experiments in making these cheeses, similar to those carried out in the Dairy at the Newcastle Show in 1908, were repeated at Gloucester, the only difference in the making being that this year an acidimeter was used to test the amount of acid developed in the curd, in lieu of the hot iron test, the method pursued last year at Newcastle.

The milk from the following breeds was selected for the experiment:—Shorthorn, Red Poll, Devon and South Devon (mixed), Ayrshire, Jersey, Guernsey, and Kerry. It was originally intended to use twelve gallons of morning's milk in every case, but after the first day it was found that sufficient milk could not be obtained from each breed in the morning, consequently it was decided to use six gallons from the morning and six from the evening milkings; the mixing of the morning and evening milks being in accordance with the practice prevailing in those districts where Wensleydale cheeses are made.

Two cheeses, Kerry and Guernsey (No. 1), were, however, made from the morning's milk before it was ascertained that not enough milk could be obtained from some of the other breeds. In the case of the Guernsey, a second cheese (Guernsey No. 2) was made, but time did not allow of a second cheese being made from Kerry milk. The mixed Devon milks fell short of the quantity required, only eight gallons in all being obtained from the two milkings.

The object of the experiment was to ascertain whether the conclusions arrived at from the experiments at Newcastle were correct, and further to test the suitability of certain other milks for making cheeses of Wensleydale quality.

The milks were all heated alike, the actual process of manufacture being similar to that at Newcastle, as described in last year's report, save that with the mixed morning and evening milks only a quarter pint of the starter (lactic acid ferment) instead of from half to one pint was used, and as mentioned above, the acidimeter took the place of the hot iron test.

The following table gives the quantity of milk used in each case, the weight of curd before salting, after bandaging, when ripe, and the loss in making, as also the acidity developed.

Breed	Milk	Weight of Curd								Acidity
		Before salting		When bandaged		When ripe		Loss in making		
	Gallons	Lb.	oz.	Lb.	oz.	Lb.	oz.	Lb.	oz.	
Shorthorn . .	12	19	0	Not weighed.		9	7	—	—	·38
Red Poll . .	12	18	12	15	2	11	2	4	0	·48
Devon and South Devon . .	8	13	4	10	2	7	6	2	12	·45
Ayrshire (No. 1)	12	17	4	12	10	9	8	3	2	·60
Ayrshire (No. 2)	12	18	0	16	12	11	1	5	11	·48
Jersey . .	12	20	8	19	4	13	8	5	12	·45
Guernsey (No. 1)*	12	15	4	12	12	10	7	2	5	·50
Guernsey (No. 2)	12	17	8	15	6	10	3	5	3	·43
Kerry * . .	12	15	12	14	3	11	7	2	12	·42

* Morning's milk.
NOTE.—The weight of the Shorthorn curd, when bandaged, was not recorded.

The cheeses were sent off by kind permission of Mr. Rowntree to his dairy at Masham, in order that Miss Sykes, who made the cheeses, might look after them until they were ripe.

On September 27 they were all finally weighed and reported on by Miss Sykes as follows :—

Shorthorn.—Short of acid, not curing well ; wants using at once.

Red Poll.—Very nice flavour, but not yet ripe.

Devon and South Devon.—Showing blue, but very peculiar smoky flavour which was noticed in the curd.

Ayrshire (*No.* 1).—Very dry, not promising well, but may improve. This cheese developed too much acid in the making, for which reason a second cheese was made from Ayrshire milk.

Ayrshire (*No.* 2).—Nice flavour ; sound, but not yet ripe ; rather too close in texture.

Jersey.—Blue ; ready to use any time ; very rich ; not sufficient salt used, and consequently will not keep well.

Guernsey (*No.* 1).—Nice flavour, very rich in quality, but not ripe ; colour very yellow.

Guernsey (*No.* 2).—Very nice flavour, and showing blue; rich and good.

Kerry.—Good flavour; sound, but not ripe yet.

In consequence of this report and on Miss Sykes' recommendation, the Shorthorn, Devon, Jersey, and both Guernsey cheeses were sent up to the offices of the Society in London for inspection, the remaining cheeses being left at Masham.

These cheeses were tasted shortly after their arrival in Bedford Square by several members of the Council, who confirmed Miss Sykes' opinion.

The remaining four cheeses were kept at Masham until the end of October, when they were reported upon as follows:—

Red Poll.—Showing blue, and very nice in quality.

Kerry.—Very good in quality, but not blue.

Ayrshire (*No.* 2).—Very blue, and ready to use.

Ayrshire (*No.* 1).—As hard and dry as when last reported on.

On arrival in Bedford Square these cheeses were also inspected and tasted by several members of the Dairy Committee, who agreed with Miss Sykes' remarks.

From the above it would appear that from ·40—·50 is the right amount of acidity in the curd to ensure getting good cheeses, as the Shorthorn curd which developed only ·38 and the Ayrshire (No. 1), which showed ·60, both failed to produce the good quality for which Wensleydale cheeses are noted.

The experiments at Gloucester, on the whole, confirm the opinions expressed in last year's report, to which the following additions may be made:—

1. That milks rich in fat make better cheeses than the poorer quality milks, and produce a heavier weight of cheese, but against this it must be noted that there is always more risk in using rich milk, and greater care is required in the making; the richer milks also require more salt. That the use of the acidimeter is to be recommended, and from ·40—·50 is the right amount of acidity to obtain in the curd.

It is only due to Miss Sykes to point out that the work in carrying out and storing the cheeses, &c., received from her throughout the most careful and intelligent attention, and to her and to Mr. Rowntree, for allowing the cheeses to be sent to his dairy, the thanks of the Society are due.

I desire also to record my thanks to the Assistant Stewards, the Hon. John R. de C. Boscawen and Mr. Alan Gibson, as well as to Mr. Gilbert and the staff of the Dairy.

ERNEST MATHEWS.

Little Shardeloes,
Amersham.

AGRICULTURAL EDUCATION EXHIBITION.

It was very gratifying to see the number of institutions devoted to either agricultural teaching or research, or to both, which took advantage of the Society's Show at Gloucester. It was noticeable in some cases more especially than in others, that the space allotted, which of necessity cannot be large, was barely sufficient to allow of the exhibits being seen well enough to be properly appreciated. It therefore becomes a question for those responsible to consider whether their exhibitions are not getting to include more material than is desirable or even warrantable.

A considerable portion of the available space was taken up by what might be described as technical exhibits pure and simple. For however good of their kind many of the specimens shown may have been, no stretch of imagination could include them in a class even remotely appertaining to agriculture.

While treating of this matter it may be well to draw attention to the question of those exhibits illustrating "Nature Study" work. That this subject, granting of course that it be skilfully given an agricultural bias, is of inestimable worth to the rural community, no thinking person will question. Nevertheless, its inclusion at the expense of more advanced matter might conceivably become, unless due caution and discretion be observed, a drawback to the advantages that ought to accrue from this Exhibition.

Exhibitors in this department of the R.A.S.E.'s Show may be held to incur some responsibility in undertaking to illustrate to the farmers of England what they are doing to further his interests. The agriculturist going round the various stalls may well want to see illustrations of the latest development of knowledge that is likely to help him in his business. He may reasonably expect to receive explanations about the various exhibits that will enable him to understand, and therefore be the better able to apply, the many intricate details which freshly acquired knowledge may introduce into his practice. Moreover, in the case of every intelligent farmer who happens to be the father of a family, there will be above all a desire to find out whether the College or University training available is so ordered as to be of the utmost possible value to his son.

In the present state of agricultural opinion there is even more remaining to be done. A certain number of men, not so many it is true as formerly, but still numerous, go to this particular department simply to scoff at the education which they themselves never received. To convince the individual

of this class that his success—for it is only successful men who can afford to scoff—was won in spite of, and not because of want of education, is no small part of the exhibitor's duty.

These objects are so important and the process of attaining them such a vast field, that when one considers the very limited space available, one might suggest without presumption that the inclusion of altogether an undue proportion of exhibits illustrating "Nature Study" is of doubtful advantage, and that others not even remotely connected with agriculture are altogether *de trop*.

Mr. Bowen-Jones, whose experience of such work must be unique, once again acted as Steward to this Exhibition.

The following account of the exhibits must, owing to the demands upon our space, be very brief. A very large proportion of the readers of this Journal will, it is hoped from knowing the great crowds that thronged the Exhibition, have seen everything that was to be seen for themselves.

The first exhibit figured in the catalogue was that of the **Lawes Agricultural Trust.** No agriculturist with the slightest pretension to acumen could fail to notice the extraordinary interest of a series of maps which was on view here. These maps, showing how certain crops, different kinds of live-stock, and other agricultural matters may be found to be associated with different soil formations, make up an agricultural survey of the south-eastern counties which, for detailed information, must be without parallel in the history of British rural investigation. The producers of this work have set an example which must furnish inspiration to all those who seek for truth in matters affecting the world's knowledge of agriculture.

The Royal Agricultural Society of England had many interesting items besides the collection of the Society's publications. *The Botanical Department* showed many exhibits illustrating the latest developments in the various problems under investigation. *The Zoological Department* showed some coloured diagrams of insect pests. There was also a display of graphic answers to the many questions that Dr. Voelcker is investigating for the Society at the *Woburn Experimental Station.* It was to be seen that in the cases of acidity in soils and the use of lime, and in the division of soils into their component parts and the influence of magnesia progress had been made, last year's work having brought out further useful information. The *Soya Bean* and *Soya Bean Cake*, the novelty which constitutes so welcome an addition to the concentrated feeding stuffs used on the farm, were on view. *Per contra* the skilful admixture of sawdust and gypsum which the Society has been so successful in preventing certain dealers from passing off as "schules," was also

to be seen. Even did space allow of it, cold print could give no adequate idea of the interest of this exhibit. Once again was this much enhanced, as visitors had the advantage of Mr. H. M. Freear's interesting and untiring efforts to explain the innumerable items necessary to illustrate the complicated matters dealt with in the Exhibition.

The Cambridge University Department of Agriculture provided the next display found mentioned in the catalogue. Almost the whole of the space in their bay was occupied in showing how the problems of plant breeding are being investigated. Here were to be seen the different varieties, gathered from all over the world, of wheat and barley used as "parents." Graphically set out, this exhibit showed how the different characters found either in wheat or barley are to be combined by cross breeding. Furthermore, it was demonstrated how good qualities can be retained and bad qualities rejected by selection from among the "hybrid" plants obtained by such crossing. In the case of wheat the illustration was carried still further, for loaves were on view made from wheat which had received the "strength" necessary to the shapeliness of the loaf from a foreign parent. This "strength," it should be noted, had been combined with the heavy cropping power of the British grain. A corner of this exhibit was devoted to showing how it is hoped that in the future such useful breeding may be carried on with live-stock as well as with plants.

The South-Eastern Agricultural College, Wye, Kent.—Fungoid pests and insect enemies attacking fruit was the main entry shown by this College. Admirably set out and labelled in a distinct and very instructive manner, numberless forms of life had been brought from the east of England to illustrate this subject. The educational value of these living examples is inestimable, as is also that of the appliances and materials found to be successful in eradicating or suppressing the innumerable enemies of the fruit farmer. The difficulty of mounting dried specimens, laborious as this work is, is as nothing when one considers the trouble which must have been taken to get together the display of live things which was shown in this stand. "*Wools of various breeds of sheep illustrating different qualities, &c.*," was also an excellent exhibit, and when one considers the possibilities there are for increasing knowledge as to what is "quality," how it may be obtained, and how, when once obtained, it should be cared for by the wool farmer, its usefulness is undeniable.

The Agricultural Education Association collection of leaflets was much the same as in previous years. No doubt there were many new issues containing valuable information, but

as it was not found practicable to ascertain which they were, it is not possible to comment upon them.

The Royal Agricultural College, Cirencester, showed by many interesting items that it was anxious and fully equal to the task of representing local advanced agricultural education on the occasion of the "Royal's" first visit to Gloucester after an interval of fifty-seven years. A very neat arrangement of framed photographs, revolving in a case, showed an admirable way of economising space well worthy of adoption by other exhibitors in the future. Often much that is well worth studying is, in the crowded state of an exhibition, difficult to get at for want of proper display. It was gratifying to see that this, the doyen of the Colleges believes in practical instruction, as was shown by some very excellent working models made by the students.

The Harper-Adams Agricultural College, Newport, Salop.—While previously it has been mentioned that the inclusion of nature-study matter in these exhibits may, by crowding out other matter, interfere with the more advanced work that educationists have in hand, one can but mark the excellence of the display of this kind at the stall of this College. The *portable* model of a working garden was as obviously useful as it was simple and ingenious. There were also to be seen here other instructive items covering a wide range of subjects, and including a very complete exhibit of "*Dairy Produce to illustrate the work done by students.*"

The National Fruit and Cider Institute brought prominently before the visitors the results of many useful investigations carried out by the Institute in the interests of the orchard owners and fruit growers of Great Britain. The influence of soil upon fruit, the effect of good pruning contrasted with that of bad pruning, and ciders fermented with different yeasts, were all displayed graphically in an instructive manner. *Methylated spirit and colza oil mixture*, a new, cheap, and efficacious wash, was not only to be seen, but all who cared to listen could learn how and when it should be painted on the affected bark of the apple tree, so as to secure results as successful as those already obtained by its use at the Institute.

Royal Meteorological Society, 70 Victoria Street, Westminster.—The interesting exhibit of the Royal Meteorological Society, which illustrated their educational work, was arranged on similar lines to their exhibits at the Shows at Lincoln and Newcastle-on-Tyne. Much local information as regards rainfall and other climatic conditions, chiefly in a diagrammatic form, was also included.

At the Climatological Station in the grounds adjoining the Exhibition building, Mr. W. Marriott gave demonstrations

each day on the "Method of taking Weather Observations," which included the ascent of registering balloons with meteorographs, or pilot balloons for ascertaining the drift of the upper currents of the atmosphere. Registering balloons with a meteorograph attached for recording the pressure and temperature were sent up on the 22nd, 23rd, and 24th June. Two of the meteorographs, dropped when the balloons burst, were found and returned. The balloon on the 23rd fell near Marlborough, 37 miles south-east by east, and that on the 24th fell at Bromsgrove, 43 miles north of Gloucester. The records showed that the temperature decreased uniformly up to between 5 and 6 miles, above that height the temperature increased somewhat, and then kept nearly stationary up to the height point reached by the balloons, about 12 miles. On the 23rd the lowest temperature recorded was —58° F. at a height of 5·8 miles, and on the 24th the lowest temperature was —63° F. at 5·9 miles. These differences in temperature may possibly have been due to the fact that the balloon on the 23rd ascended on the eastern side of the cyclone, while that on the 24th ascended on the western side of the cyclone, which was the cause of the wet and unsettled weather during the time of the Show.

The following extract from the "Monthly Weather Report" for June describes the unusual weather conditions which prevailed during this period :—

"On the morning of the 19th the high-pressure area was taking up a more southerly position on the ocean westward from the Bay of Biscay, and there were indications of the existence of a disturbance to the westward or south-westward of Iceland. Wireless reports from steamers beyond the north of Ireland showed that in the evening of the same day the depression was rapidly spreading down upon our north-western coasts. Subsequent reports, however, disclosed a cyclonic system which was extraordinarily slow and erratic in its movements. Its minimum of pressure did not reach the neighbourhood of Galway until the evening of the 21st. Growing deeper it passed back to Mayo by next morning, the barometer sinking below 29·5 in. over the kingdom generally, and at Blacksod Point it touched 29·18 in., the lowest reading for the month. Then gradually diminishing in intensity the system wandered on an irregular path to the neighbourhood of Southampton by the morning of the 24th, afterwards passing across south-eastern England to the Wash and the lower part of the North Sea. Returning westward its centre reached the Yorkshire coast in the morning of the 27th, and two days later the disturbance was completely dispersed over the north of Ireland, other shallow depressions then appearing on the Continent between Spain and Scandinavia.

The 19th witnessed the end of the dry weather, and from the 20th to the close of the month the conditions were of a most disturbed character, nearly the entire period being under the influence of the slow-moving pressure system whose progress has been described above. Every day thunderstorms were experienced, and except on the 25th, 26th, and 30th, they affected extensive regions in Ireland and Scotland, as well as in England. Rain was general, frequently heavy. and in some localities accompanied by hail. At Clifton 1·3 in. was measured on the 20th. On the 21st, rainfall exceeding an inch

occurred in various parts of Ireland, 1·5 in. at Blacksod Point, also at Rothesay. Next day the largest falls were all in the north, 1·3 in. at Carlisle, Colmonell, Kilmarnock, Glasgow, and Wick, and 1·7 in. at Dumfries. More than an inch fell in the Birmingham district on the 23rd, and in eastern Ireland, Bray had 1·2 in., and Kingstown 1·4 in. There were again several large amounts over England on the 24th, ranging up to 1·5 in. at Garforth, and in Ireland, Broadford, Clare, had 1·4 in. On the 28th Ruthin had a fall of 1·5 in."

It is impossible to conclude even this brief report without alluding to the unremitting attention and courtesy shown by all the officials on duty at the various stalls, for, without the very interesting explanations given by these gentlemen, much of the very instructive material on view could not have been adequately appreciated.

FORESTRY EXHIBITION AT GLOUCESTER, 1909.

THIS exhibition was undoubtedly the most important forestry collection ever seen in England. Great credit is due to the hearty co-operation of the Royal English Arboricultural Society with the Royal Agricultural Society in the organisation of this splendid series of exhibits, which comprised no less than 248 separate entries, and illustrated in an admirable manner the whole field of sylviculture, utilisation of timber, and forest protection.

For the first time, a gold medal was offered for the best general collection of exhibits in the Forestry Section of the Show, and this no doubt stimulated interest amongst land-owners and foresters. It is greatly to be hoped that this gold medal will be offered annually, in the future, and become a permanent attraction to exhibitors.

The gold medal was awarded to the Earl of Dudley, who must be congratulated on the energy displayed by his forester, Mr. Braid. The selection and preparation of this exhibit from Witley Court must have extended over many months, and have involved great labour and care. The Earl of Dudley succeeded in obtaining seven silver medals and one bronze medal in the fifteen competitive classes, and also made a good show in the five non-competitive classes. Equal praise must also be given to Mr. H. J. Elwes, F.R.S., for his valuable contribution to the Show, which illustrated in a striking manner the uses to which many of our home-grown timbers can be applied. Of the other exhibitors, Mr. Morgan P. Price, Earl Beauchamp, the Marquis of Exeter, the Earl of Carnarvon, and Mr. T. J. M. More may be singled out for the interest and excellence of their varied exhibits.

With regard to the production of our staple hard woods—oak, ash, elm, and beech—the exhibits in Class 1° from nine competitors showed that in technical quality England can supply as good timber of these species as any part of the world. The Earl of Dudley showed two oak planks, 30 in. wide, which were absolutely flawless. These were cut from the butt of a tree, 140 years old, that had grown in a mixed wood of oak, ash, and chestnut. Earl Beauchamp showed planks nearly as good, 26 in. wide, cut from an oak tree, growing in heavy clay land, amidst pasture. The supply of oak of the first class is a limited one, seeing that the great forests of *Quercus alba* in the United States are now being cut to a finish; and the oak woods on the continent of Europe will probably not continue to yield in the future much for export. Oak can scarcely be usually recommended as a tree to plant as an investment, but there is a chance that where it can be grown quickly on deep loam it may give at no distant date a handsome return.

While there may be some doubt as to the advisability of growing oak for profit, nothing can be said against the desirability of planting ash in suitable situations, and of encouraging the growth of selected ash poles in mixed woods. The ash shown at Gloucester in Class 1° was of exceptionally good quality; and two planks, 23 in. in width, from Witley Court, were quite flawless. These were cut from a tree, seventy-five years old, grown in deep moist sandy loam, at 260 ft. elevation, near a stream, in mixture with oak, chestnut, and beech. Ash in such situations grows tall and straight, producing white and clean timber, with annual rings, varying from five to eight per inch. The interesting series of boards of different species of trees, grown on different soils, from Witley Court, shown in Class 6°, proved that in similar mixed woods, ash is quite as good on clayey loam as on sandy loam. Where the soil was stiff clay, the trees were small in size and inclined to be black-hearted at an early age, the timber being inferior in quality and much slower in growth, with the rings about seven per inch near the centre and eighteen per inch on the outer side. On light calcareous and light dry sandy soils, the ash was still poorer in quality, the trees becoming, as shown by the exhibits, black-hearted before they attained sixty years of age. On light sandy soil, at 600 ft. elevation, the ash remained stunted and was badly cankered.

The English elm is usually only seen in hedge-rows in the south of England, and has rarely been introduced into our woodlands. A board, 32 in. wide, from Witley Court, cut from a tree growing in a mixed crop of oak and chestnut, was remarkably clean and free from knots, and superior to the hedge-row elm sent by the other exhibitors. The elm is

rather a neglected tree as a component of deciduous woods; and as both the English elm and the Huntingdon elm are, in the south of England at least, fast-growing trees, which would act as soil-improvers, they might be planted successfully in many situations.

The specimens of beech were very fine; but nothing of special interest was shown, except one of Mr. Elwes' numerous exhibits, a wonderfully well-preserved plank, many hundreds of years old, taken from the foundation of Winchester Cathedral. The importance of beech in sylviculture is now universally admitted by British foresters; but the price remains low, except in the Chilterns, and nothing has been done to extend the use and enhance the price of beech timber in this country. This is to be regretted, seeing how largely this wood is used for railway sleepers in France and Germany. It is also, in Denmark and France, increasing in importance for making casks. It pays apparently, as I saw last summer, to export beech staves from the banks of the Drina in Servia as far as Marseilles. I may note here that the subject of the extension of the profitable use of many kinds of home-grown timber is greatly neglected, though at the Gloucester Show it was illustrated by some of Mr. Elwes' exhibits.

In Class 3°, Specimens of Miscellaneous Kinds of Broad-leaved Timber, a good show was made by the Marquis of Exeter, thirteen species; Earl Beauchamp, twelve species; and the Earl of Dudley, twenty species. With this group must be mentioned the magnificent collection, shown by Mr. Elwes, of about 100 different species of British-grown timbers, which were shown on both sides of the Education Building. Many rare and interesting kinds were included, amongst which I may mention a fine board of grey poplar, with wavy grain; a board of black poplar (*Populus nigra*), showing curious figure, cut from a tree with a burry trunk; a plank of the hop-hornbeam (*Ostrya*), one of the rarest trees in cultivation; black walnut,[1] a fine plank, nearly 3 ft. wide, and equal in quality to imported wood from America; birch, a plank with remarkable figure, resembling the kind that is so much valued in Finland and northern Russia; *Quercus Ilex*, a quartered board from an old tree, showing a beautiful grain and dark heartwood, &c.

The most interesting species in this section, from a sylvicultural point of view, were perhaps the Black Walnut, already referred to, the Turkey Oak, and Spanish Chestnut. The two latter, trees of southern Europe, which grow with great vigour in the southern parts of England and Ireland, are worth

[1] This tree can possibly be grown for profit on good soil in the south of England, as it produces an excellent timber which sells at a very high price, which may possibly increase in future years.

perhaps some special attention. The Turkey Oak, it is true, both in its own home (as in the Balkan States) and also in England, produces timber, which is rather despised, as it is unsuitable for use out-of-doors; but it is of value for indoor work. Its possible use is for planting in small quantity, in mixture with the sessile oak, on hilly land. It would probably serve, with its rather shade-bearing quality, as a substitute for beech to some extent. In nearly all parts of the world where oak forests naturally occur it is noticeable that two species are found growing together—one allied to the common oak, producing acorns in the first year; the other, like the red oak of America or *Q. Cerris*, ripening its fruit in the second year. A very fine plank of Turkey Oak was shown by Lord Dudley. The Lucombe Oak (the original tree, and not its descendants), which is very vigorous in growth, might also serve for the same purpose as the Turkey Oak, and Mr. Elwes showed a beautiful cabinet made of this wood.

The Spanish Chestnut is one of the broad-leaved trees, the cultivation of which might be increased on suitable soils in the southern parts of England and Ireland. The Earl of Dudley showed a good plank, 27 in. wide, from a tree ninety-five years old, which had grown in mixture with oak, ash, and larch, on deep sandy loam in a sheltered situation. This tree contained about 170 cubic feet of timber. Mr. Braid informed me that, at Witley Court, chestnut timber on sandy loam and on clayey loam was practically free from shake. It grows, however, faster on sandy loam than on clayey loam. On dry deep sand it is slow in growth and inferior in quality. In Class 6°, a specimen illustrated well the ill effects of altitude and exposure on this species. At 700 ft. elevation, in an exposed situation, the chestnut had only attained 4 ft. in height at forty years old. Another specimen showed its distaste for lime—a tree growing on calcareous soil, though favoured by a low sheltered situation, being only 21 ft. high at seventy-eight years old; and most of the chestnuts that had been planted here had died.

I need not refer in detail to the many interesting exhibits of coniferous timber, which were shown in Classes 2° and 4°. Mr. T. J. M. More, of Linley Hall, showed a log cut from a larch tree which is said to have been planted in 1738, a week before the famous larch trees of Dunkeld and from the same batch of seedlings. The seed is stated to have been brought from the Tyrol by Robert More, M.P., F.R.S. This old larch grew on oolite at about 700 ft. elevation. In Class 11° Mr. More obtained the first prize for an excellent gate made out of the timber of this tree.

Earl Beauchamp, in one of the non-competitive classes, showed ten remarkable larch poles which were cut out of

a plantation at Ketford, Dymock, which gained the silver medal in one of the plantation competitions. This plantation was made nineteen years ago with four-year-old plants, and averaged 800 poles to the acre. The poles measured about 45 ft. in length, from the butt to a point near the tip, where they were 2 in. in diameter, the total length of the trees being about 50 ft.

There were three exhibits illustrating the different rates of growth and varying qualities of the wood of Scots Pine, grown under varied conditions of soil and climate.

Mr. M. P. Price had taken great pains to collect a most interesting series of boards and sections as follows :—

A. Dantzic fir, imported from Dantzic, showing coarse grain and large but sound knots. Mr. Price states that such timber is of chief value for beams, rafters, and sills.

B. Section of trunk of Scots Pine brought by Mr. Price from the forests of the Ulea river, in Finland (lat. 64° 50′). This tree grew on loose porous sand.

C. First Archangel Redwood, imported from Archangel, showing the finest quality of Scots Pine available ; used for first-class joinery work.

D. Boards and sections, cut from Scots Pine grown on red clay in the Severn Vale : open-grained, sappy, and knotty ; used as boarding and rafters for sheds, and for estate purposes.

E. Specimens of Scots Pine, grown on the old red sandstone in Monmouthshire : coarse, open and sappy ; considered by Mr. Price to equal imported 3rd Archangel.

From Witley Court there were four sets of boards of Scots Pine :—

	Years old	Crop, soil, and situation	Width of plank	Heartwood	Sapwood
A	125	Pure crop ; on light sand, gravelly subsoil ; low altitude.	27 in.	21 in. wide, 64 rings.	3¼ in. wide on each side, 58 rings.
B	130	Mixed with beech ; sandy soil over gravel ; 900 feet altitude, exposed hill.	15½ in.	10½ in. wide, 68 rings.	2½ in. wide on each side, 60 rings.
C	95	Pure crop ; deep sand ; 250 feet altitude.	23½ in.	6½ in. wide, 33 rings.	8⅝ in. wide on each side, 61 rings.
D	53	Mixed with oak and spruce ; clay soil ; low altitude.	13½ in.	6 in. wide, 22 rings.	3½ in. wide on each side, 23 rings.

A was a remarkably fine board with deep red heartwood ; B a good board with bright red heartwood ; C and D had developed little heartwood, that of D being very dull in colour.

Mr. Elwes showed planks of Scots Pine, grown on his estate at Colesborne :—

A. From a tree quickly grown on clay soil: coarse in texture, nearly half being sapwood, but free from knots. Mr. Price considered this to be intermediate in quality between 2nd and 3rd Archangel.

B. From a tree grown slowly on oolite: finely grained and sappy, free from knots; considered by Mr. Price to be equal to 2nd Archangel.

The Earl of Dudley also showed in Class 6° a large number of boards and sections of larch, of various ages, and grown under varied conditions. Trees grown in dense crops had long stems, the sections showing close and regular annual rings; those grown in open order had short boles, with sections exhibiting wide and irregular rings. With regard to soil, Mr. Braid supplied the following notes:—Larch grown on very deep sand show vigorous growth in the early stages, but do not attain a large size, and are at their best when about sixty years old. Larch grown on poor calcareous soil, on a low hill-side with a north aspect, were of good quality and growth, maturing about sixty years of age. Larch grown on stiff clay, as scattered trees amidst oak, were poor in growth, and showed signs of decay when sixty-five years old. The largest and finest specimens of larch, of which specimen planks about 2 ft. wide were sent from Witley Court, were cut from trees about ninety-five years old, grown on light sandy loam in a low situation, scattered singly through a wood of Spanish Chestnut, Oak, and Ash.

In Class 8, Earl Beauchamp was the only exhibitor. He sent an interesting series of specimen stems, with boards cut from them, of Scots and Austrian Pines, Spruce, Larch, and Oak, illustrating the effect of dense and thin crops on the suppression of branches and the resultant quality of the timber.

In Classes 7 and 9, the Earl of Dudley made a surprisingly varied and extensive exhibit, which exceeded what one often sees of the same kind in permanent forestry museums. The specimens illustrating the effects of good and bad pruning, of summer and winter pruning, were well chosen. Other specimens illustrated in great detail the injuries done to forest trees by animals, parasites like mistletoe and woodbine, fungi, &c. I noticed specimens showing the attacks of water-voles on poplars and willows, 3 in. in diameter at the butt. There were some interesting examples of larch canker (*Peziza*) following definite wounds, as peeling by rabbits; and in one case, where a larch growing in a hollow had its leading shoot killed by frost, the canker commenced to show at the base of the dead

leader. The damage done by woodbine and mistletoe was turned to useful purpose by conversion into walking sticks of a fantastic kind, of attacked oak, ash, hazel, and sallow. Sixteen kinds of witches' brooms were shown, that of the Douglas Fir being the rarest. Twenty-six kinds of burrs, besides many other curious growths, were also exhibited. However, a complete catalogue of this remarkable collection of abnormalities would take up too much space—that of damage done to ash by hornets being perhaps the most curious. I may also mention, as showing the noxious character of the rabbit, that Mr. Braid pointed out specimens of strong plants which were killed by this animal, even after they had been plastered with much advertised protective compositions.

Earl Beauchamp and Lord Sherborne also contributed to the exhibits of specimens of trees damaged in various ways, and a good show of similar character was sent from the Forest of Dean by the Commissioners of Woods and Forests. Mr. Benjamin St. John Ackers exhibited several remarkable specimens, illustrating the injuries caused to even sound trees by the attacks of woodpeckers.

In Classes 10, 11, and 12 there was a large show of gates of various kinds, mostly of such excellent quality that the task of the Judges in discriminating the best and second best for prizes was very difficult.

In Class 16, Seedling Trees and Transplants, only one public nursery entered, the King's Acre Nurseries, Ltd., Hereford, who sent a fine collection of plants in earth in boxes. Amongst the rarer kinds, I noticed excellent examples of *Cupressus arizonica*, a beautiful ornamental tree, which appears to be quite hardy, and is worthy of a place on the lawn or in the park. A good collection of varieties of the Lawson Cypress included *var. pygmaea*, a plant only 3 ft. high, which had been in the nursery more than twenty-four years. There were also fine specimens of *Picea pungens*, with a good colour. I need not allude to ordinary forest trees, which were well represented. The trees appeared to be fairly accurately named, though such errors occurred as *Abies excelsa* instead of *Picea excelsa*. It is high time that the nomenclature of trees should follow established rules, and as the Kew Handbook can be obtained for a few pence there is no excuse for error. *Picea nigra* was correct, though usually the confusion between this tree and *Picea alba* is extreme.

There were good examples of the common oak, *Quercus pedunculata*, but I looked in vain for *Q. sessiliflora*, which is the better tree on many soils. It is still astonishingly difficult to procure in England either acorns or plants of the sessile oak; and one is obliged to refer inquirers to German nurseries,

though home-grown oak is preferable in England to oak imported from a different climate like that of Germany.

I noticed plants of both *Betula pubescens* and *B. verrucosa* under the same name (*B. alba*), yet these are two very distinct species, adopted for successful growing on very different soils. Nurserymen should try and distinguish the species of common trees like oak and birch. I found the common alder, but the grey alder, which is excellent for many purposes, though not a native tree, was not shown.

Class 14^{c}, Articles of Domestic Use or Furniture made from Home-grown Timber, was one of the most interesting sections of the exhibition, and great praise must be bestowed on Mr. Elwes for his exhibits. These illustrated well the fact that it is not necessary to seek abroad for the choicest timbers, when we can find at home in our parks and woodlands excellent material for furniture-making. One beautiful cabinet was made of Lucombe oak, from a log of a tree in the old Exeter nursery. This tree was cut down in 1903, and the log, being considered worthless, was sold at the price of firewood.

Mr. Elwes also showed a pretty cakestand, made from the wood of a Laburnum tree grown in Scotland; a splendid chest constructed of beautifully figured Spanish Chestnut, grown in Wiltshire, with panels of bird's-eye oak, grown in Gloucestershire; a commode made of black walnut, grown at Woodchester Park, near Stroud; a very handsome chair made of wild cherry; a holly chair with a maple seat; a door made of Spanish Chestnut with panels of rent brown oak; a door made of yew. Mr. Elwes has already done a great deal to revive the fine art of panelling, and exhibited some panels of solid brown oak, representative of the work done in his dining room at Colesborne. There were also many excellent specimens of veneers, the most interesting, perhaps, being those of brown oak, which were cut by the Pullman Car Company, U.S., from a tree growing in Rockingham Park, Northamptonshire. One veneered panel of pollard brown oak was of immense size, 8 ft. long by 2½ ft. wide. Mr. Elwes also showed some nice examples of parquet flooring in different designs. A rather novel use of wood was shown in the case of four volumes of the "Trees of Great Britain and Ireland," which were bound in different styles with wood boards—two of brown oak, one of Lucombe oak, and the fourth of yew. Nearly all these interesting articles were constructed by Mr. Elwes' own carpenter, and were excellent in style—the main object of his exhibits being to point out the numerous æsthetic uses to which our own home-grown timber may be put. As Mr. Price has remarked, "if this exhibit showed nothing else, it showed the English timber merchant what

he might gain by a more thorough knowledge of the properties of some of the rarer woods which he from time to time handles. Mr. Elwes certainly deserves the gratitude of all timber merchants for this exhibit."

The Forestry building was conveniently arranged, though not large enough for all the exhibits, many of which, including the rarer kinds of planks, were displayed outside, and perhaps suffered from the inclement weather that prevailed. The building was ornamented with a large collection of photographs, the greater portion being contributed by Mr. Elwes. These comprised a selection of pictures of the most remarkable and rare trees in Great Britain and Ireland. Photographs of plantations were also sent by the Commissioners of Woods and Forests, by the Earl of Dudley, Sir Henry H. A. Hoare, Lord Sherborne, Mr. B. St. John Ackers, and Mr. M. P. Price. One of the most curious was that of a remarkable elm at Huntley Manor, which had formed a natural arch over a brook.

There were doubtless many other features of interest at the Gloucester Forestry Exhibition, the finest ever held in England; but I can only apologise for their omission by pleading the restrictions of space and time.

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HORTICULTURAL EXHIBITION AT GLOUCESTER, 1909.

ON the occasions of the visits of the Royal Agricultural Society to Lincoln and Newcastle, opportunity was taken to hold a Horticultural Exhibition in connection with the Agricultural Show. Such an exhibition proved not merely very successful, but was undoubtedly a very popular and attractive addition to the larger undertaking. The Gloucester Local Committee, after some hesitation, decided to attempt one. Any financial difficulty was met by the generosity of private individuals. As no exhibition of the kind had ever been held in the county before, there was only a modest expectation of success, but this was far surpassed in the result.

The Exhibition was opened to the public at 3 p.m. on Wednesday, June 23, after a private visit by H.M. the King, and closed at 5 p.m. on Saturday, June 26. This was rather a long period for the exhibits to maintain their freshness unfaded. But the weather, which with few intervals was deplorable, had at any rate the advantage that the atmosphere in the tents remained cool and moist and kept the flowers and

foliage in a condition which would have been impossible had the temperature been high.

A charge of admission of one shilling was made on June 23, and up to one o'clock on June 24. The Council of the Royal Agricultural Society assented to this with some reluctance, and was unwilling to establish a precedent for side shows with payment. But the object of the Local Committee in urging it was by no means to cover part of the expense. When a horticultural exhibition is densely thronged, as was the case on the free days, the visitors have to be content with a mere glimpse of the general effect, and any critical inspection of the exhibits becomes impossible. It is probable that those whose object is leisurely study and comparison, and who do not regard the exhibition as a mere sight but as an opportunity for learning something, would willingly pay more for the privilege than what was actually charged.

The Royal Horticultural Society supported the exhibition by sending a deputation, including the President, Sir Trevor Lawrence, Bart, K.C.V.O., and Secretary, the Rev. W. Wilks, to visit the show on June 23, "to supplement the prizes by awarding Royal Horticultural Society medals and commendation cards to any exhibits they may consider deserving."

The Royal Agricultural Society moves with the times and with the co-operation of other societies and organisations includes in its Show any new work connected with the land. At Gloucester there were two subsidiary exhibitions of remarkable interest. There were the Agricultural Education and Forestry Exhibitions, which will be noticed elsewhere; the former was probably quite unique of its kind. Some doubt has, however, been expressed as to whether the refinements of the horticultural art are not too remote from agricultural practice to justify its being represented, and it is worth while saying a few words in its defence.

No doubt at first sight such a superb collection of orchids as was seen at Gloucester has no relation to agriculture. But it represents the high-water mark of cultural skill. And in an exhibition it must be permitted to show to what point the standard of excellence can be raised without reference to utilitarian results. It is not difficult to show that the art which has reached its culminating point in orchid culture has rendered substantial service to agriculture. To the professional eye the collection of vegetables, with some eighty exhibits, shown by the Hon. Vicary Gibbs, was scarcely less noteworthy, and the same remark might be made of the fine collection of fruit-trees in pots sent from the King's Acre Nurseries at Hereford. In all three cases success has only been obtained by the intimate study of the conditions of plant-growth which

lead to their efficient control. It is scarcely a paradox to say that it requires art and knowledge of the same order to produce a *cattleya* as a cauliflower. But there is this distinction to be noted. In the former case the gardener only produces under adverse conditions what nature under different ones achieves without an effort; in the latter case the subject of cultivation is itself the result of the cultivators' persistent labours. All our great seedsmen divide their work between the garden and the field, for the supply of both are ultimately dependent on the same principles and methods. The Continental agriculturist, to take a notable example, owes the sugar-beet to the De Vilmorins. The field has continually to go to to the garden to be stocked. It is to the skill of the hybridiser acquired in the garden that the farmer looks for new strains of wheat.

But the case for the relation of the two can be drawn even closer. It is only in cool climates that they seem opposed. The division disappears with increase of temperature and as the plough gives way to the spade. Horticulture is only, in fact, the intensive side of the cultural art. This is conspicuous in the market-garden, where horticulture and agriculture blend. The French methods, which at present attract so much attention, were fully described by Mr. W. Robinson more than a quarter of a century ago. They have long been practiced to some extent in the neighbourhood of London, but are probably most completely carried out at Evesham. It was not found possible to induce the growers there at a somewhat short notice to exhibit the system in actual operation. But this was eventually accomplished by the kind aid of Messrs. Sutton, of Reading.

One of the most remarkable social features of our time is the popularity of gardening and the passion for flowers. This is in part due to the increase in national wealth and the general rise in the standard of comfort. Even the poor can afford some little margin for personal gratification. But another factor has been the cheapening of production. Flower-farming has become a branch of agriculture. Within the memory of the present generation the daffodil was wholly neglected. Farms are now devoted to its cultivation in multitudinous forms; they are the staple industry of the Scilly Islands, and the streets of our cities are bright with them in the spring. But a few years ago carnations of the type of the "Souvenir de Malmaison" were the exclusive possession of the wealthy. The somewhat intractable difficulties of their cultivation were mastered in their gardens; they are now grown on a large scale for cut blooms, and have become the basis of a considerable and profitable industry.

They were a conspicuous feature in the Gloucester Exhibition, where they were finely shown by numerous growers.

The cultivation of herbaceous plants is a striking feature in modern gardening and is within the reach of the most modest means. Their supply must in the aggregate maintain a considerable industry. They were amply shown at Gloucester by exhibitors too numerous to particularise. An exception, however, must be made for the herbaceous pæonies sent by Messrs. Kelway; they formed an exhibit which for quality and arrangement has probably never been surpassed. The cultivation of sweet peas has almost become a national craze; they were shown at Gloucester in infinite variety.

The Royal Show is held too early in the year to admit of outdoor fruit being represented. There is no cultural industry which stands in more need of improvement and stimulus. That there is an almost inexhaustible popular demand for fruit is incontestable. It is singular that it appears to be more readily met from our colonies than from home. Insufficiency of cheap and effective means of distribution appears to be one obstacle, though the apathy of the cultivator and his indifference to quality is no doubt another. The treatment of so called "vintage fruit" is for the most part deplorable. No care is bestowed on the trees and little on the collection of the crop. Any one who has travelled in France must be struck with the different and assiduous care bestowed on the vine and the prune.

The neglect of outdoor fruit is the more remarkable as in regard to that which requires protection there is a constant effort, as in the case of cut blooms, to produce more cheaply what has hitherto been only within the reach of the well-to-do. Glass is inexpensive and its use for market purposes probably began in the Channel Islands. Acres of land are now roofed over in the southern counties for the production of tomatoes and grapes. A profitable trade in the latter sprang up with Paris but was promptly destroyed by a prohibitive duty.

Whatever may be the ultimate fate of the small holdings in the country at large it is probable that their success will ultimately depend on a mixture of agricultural and horticultural methods. This is particularly the case in the neighbourhood of large towns where there is a continually increasing demand for cut flowers and vegetables. But the cultivator will do best if he can supply his customers directly. If he can add fruit of good quality as well it is undoubtedly remunerative.

Beyond indicating the prominent features of the show it is unnecessary to discuss in detail the individual exhibits. Justice was done them at the time in the horticultural press. But something may be said as to its larger characteristics.

The Local Committee was fortunate in securing as horticultural manager the services of Mr. Peter Blair, who has charge of the gardens of the Duke of Sutherland at Trentham and who had carried out very successfully a similar show at Lincoln. He succeeded in giving the Gloucester Exhibition an aspect which was altogether unique. Three tents were used, arranged in a hollow square. The centre one (200 ft. long by 85 ft. wide) was probably the largest which had ever been used in this country for a flower show. The vast space allowed groups to be arranged and effects to be produced which ordinarily would be impracticable. It was the opinion of those well qualified to judge that nothing surpassing them had ever been seen at home or on the Continent.

But success was largely due to what was nothing short of an outburst of local patriotism. It has been roughly estimated that two-thirds of the exhibits came from the county of Gloucester. Private and commercial establishments placed their resources lavishly at the disposal of the Local Committee. The result was a revelation as to the horticultural possibilities of Gloucestershire. Its sunshine and mild climate doubtless favour indoor cultivation. An interesting feature of provincial shows is the evidence they afford of the influence of local physical conditions on particular cultures. One must go to Liverpool to see crotons, and the enormous bunches of grapes which are shown in the north are unknown in the south.

Lieut-Col. Holford, C.V.O., C.I.E. of Westonbirt House, Tetbury, made a display of hippeastrums and orchids which for splendour and sheer cultural excellence could not be rivalled anywhere. The flowering of the former had been skilfully retarded and by abstaining from exhibiting elsewhere during the year Lieut.-Col. Holford had concentrated all his efforts on staging his orchids in perfection at Gloucester. It was a unique and almost unparalleled effort, and was deservedly awarded by the Royal Horticultural Society the Lawrence Gold Medal "for the finest exhibit of the year." The regret was universal that sudden illness prevented his showing his triumph to the King and witnessing the admiration which it excited on all hands. On the commercial side the varied exhibits of Mr. John Cypher whose fame as a cultivator is European were scarcely less remarkable. The large plants of *Darwinia tulipifera* shown in commemoration of the Cambridge Darwin centenary which was being celebrated at the same time were a *tour de force* of cultural skill. It is not too much to say that the exhibits of Lieut.-Col. Holford and of Mr. Cypher were the backbone of the show and secured its success. The group of indoor plants shown by the Right Honourable Sir John Dorington was universally

admired. Few private establishments could show anything surpassing it either in variety or excellence of cultivation.

A horticultural exhibition must be allowed to be attractive as a condition to popularity. But this represents the "Sporting element" necessary to advance and maintain the standard of the horticultural art. For the same reason at a poultry show, "fancy" is encouraged as well as the qualities immediately desirable for the table. If, however, a horticultural exhibition is to be a customary feature of a Royal Agricultural Show, it may be suggested that it should receive recognition from the Council and that the co-operation of the Royal Horticultural Society should be secured. It would then be possible to give the Exhibition a more utilitarian scope. Horticulture is becoming, indeed has already become, a great national industry to which the land is indispensable. As agriculture becomes more intensive, the dividing line between it and horticulture tends to disappear. The potato is a striking instance of a crop which has been transferred from the garden to the farm. We still, however, import them to the value of two millions. The wealthy will always demand early vegetables, the produce of warmer climates. But the cheapness of glass will make it possible to compete with them at home. The Board of Agriculture has repeatedly pointed out the enormous extent to which our consumption of fruit and of even the commonest vegetables is supplied from abroad. Comparatively little has been done to meet the demand, though of late years farmers have competed with market gardeners in the cultivation of greens and cabbages with which they can feed their stock in case of a glut in the market. Here there is a chance for the small holder in country districts if he can be induced to co-operate in marketing his produce.

But fruit cultivation stands in most urgent need of an impulse. Little progress will be made in the improvement of cider till our farm orchards, the condition of which is mostly deplorable, are treated with more intelligence. At Gloucester there was an instructive competition in fruit-spraying. The principle which has been adopted in giving prizes for local plantations might with advantage be extended to orchards and fruit-gardens. And the more effective management of small-holdings, of which there are believed to be some 12,000 in the county of Gloucester alone, would seem to be as much deserving of encouragement as that of farms. Indirectly this would stimulate the activity of the village Flower Shows which are already playing a useful part in rural education.

W. T. THISELTON-DYER.

The Ferns.
Witcombe, Gloucester.

PLANTATIONS COMPETITION, 1909.

Introductory.—The competition in woodland plantations was instituted by the Royal Agricultural Society of England in conjunction with the Royal English Arboricultural Society in order to encourage and assist landowners and foresters in the better management of plantations. For this purpose the Royal Agricultural Society of England provided eight silver and eight bronze medals to be awarded severally to eight classes of woodlands in the counties of Gloucestershire, Wiltshire, Herefordshire, and Worcestershire. The Royal English Arboricultural Society also gave a gold medal for the best plantation in all the classes.

It was considered that as the character of the soil and the elevations varied very considerably in these four counties, the classes should be so divided that landowners owning poor and elevated land should not be expected to compete against other owners whose land was of a better character and at a lower altitude.

For this purpose the first four of the classes were restricted to plantations at 400 feet elevation or more above sea-level, and the other classes included plantations below this elevation, and in each set, plantations intended for hardwoods were separated from those intended for conifers, and again, those that had been thinned were scheduled separately to the unthinned.

This classification, we have found, was a success; at the same time, as we have taken into account very largely the management, the classification was not so necessary as it would appear to be, and there would have been no difficulty in judging the woodlands if no distinction had been made.

Basis of Judging.—We have, in accordance with our instructions, taken into account very fully and have inquired very thoroughly into the system of management of each plantation. There have been one or two cases where it has been impossible to get full details, but for the most part we have been able to judge fairly accurately whether money has been unnecessarily expended and to what extent the plantations have been managed upon business lines and in accordance with sylvicultural methods. We found that thirty years was certainly a maximum age, for beyond that time it would become very difficult to assess cost and to find how much of the present condition is due to soil or good management, and the latter then becomes reduced very much to a question of judicious thinning.

In order to carry out the work systematically, we supplemented the questions which competitors were asked with further queries as to the original state of the land, the value of the adjoining land, and details of the thinnings ; and in every case where it was practicable or of any value, we took averages of the quarter-girths of trees and their heights. We fully annotated our inquiries and observations for the purpose of a careful comparison.

Estates Visited.—The entries covered a very large area, extending from the south-west of Wiltshire to the north-east of Herefordshire and to Worcestershire, although the bulk of them were from Gloucestershire. There were, in fact, eighteen entries in Gloucestershire, five in Herefordshire, two in Worcestershire, and two in Wiltshire; and although these in a measure represent the energy of the committee, at the same time it appeared to us in travelling through the country that they also represent to a large extent the activity of landowners in forestry work in the various counties, in which Gloucestershire takes the foremost place. The entries were by no means confined to the large estates or properties in which systematic planting was being carried on. We did not find in any instance that the woodlands generally were being managed upon any defined well-thought-out scheme ; although in many cases we found that the woodland areas throughout the estates were being carefully managed, and these areas were being extended gradually year by year.

In some cases the woodlands were in the charge of a head forester, but in others they were being managed by the agent, with the general supervision of an estate bailiff, and on more than one estate the landowner himself was personally superintending the woodlands.

Although we found two instances in which the owner was carrying out wrong principles coutrary to the better judgment of his agent or forester, still it was very marked that where the owner was interested, his woods were receiving careful attention, and it was always possible for the agent or forester to give a reason for the system that was being carried out. We found a considerable amount of enthusiasm amongst all parties concerned, and every promise of an extension of forestry operations upon the estates where the work had been begun.

Soil and its Effect.—The subjacent rock may be divided roughly into two classes : Oolite and Old Red Sandstone. We found variations of both these two main classes, but for the most part the land was of a light or sandy nature, and we only had one example of what might really be termed a heavy soil.

We made inquiries in every case as to the original state of the land, and in the twenty-seven entries we were informed the trees had been planted on arable land in fifteen cases, in four the land had been grass, and in the remaining eight the land had been either old woodland or scrub. We did not find, as a whole, that there had been any benefit accruing from any particular previous crop, although it was noticeable in two cases that very fine plantations were on land formerly used as a rabbit warren.

On the whole, the effect of good soil is by no means as striking as would be imagined, and our observations led us to the conclusion that good management and shelter are equally as important factors for success as good soil, and that where land adjoins fair roads there is every encouragement for the landowner, who is prepared to take trouble and thought with his woodlands, to grow timber upon the oolitic limestone up to the high altitude of 900 ft., and even higher.

Altitudes and Effect.—The altitudes varied between 100 ft. in Class 26, to 919 ft. in Class 25. The latter is the highest altitude of the plantation entered on the Sudeley Castle estate, and the fact that this entry was awarded the first prize in its class is some evidence of the good result that can be achieved by excellent management and natural shelter upon oolitic limestone on the higher ridges of the Cotswold Hills.

Of the whole of the entries the best plantation is that of Mr. W. T. Barneby, on the Saltmarshe Castle estate (Class 22), and this is growing at an altitude of over 750 ft., on a soil varying from a clay to a light loam, with a subsoil varying between a clay and a sandstone. The plantation, which extends to 100 acres, was formed on an area covered with gorse and scrub, from which the timber had been felled many years previously. It is said that it was cut by a former Bishop of Hereford, to whom this land, at that time a deer-park, was granted by Queen Elizabeth. The land, before the present plantation was made, was let at 4*s*. an acre, and is on an exposed plateau with no natural shelter. Another example of a successful effort to raise a plantation at a high altitude in a wind-swept situation was that of Mr. R. F. Stratton, of Puesdown (Class 25), at an elevation of 880 ft. (where the conifers might now be interlined with beech and sycamore); that of General Davies, of Elmley Castle (Class 24), at 800 ft. upon the inferior oolite, should also not be overlooked.

We noticed in more than one case that the owner in planting had taken advantage of a previous shelter-belt, and the plantation had benefited thereby. It is almost certain that where owners can utilise such shelter-belts or the lay of the land as a protection against severe gales, and also can obtain a

northern aspect, the benefits that accrue to young plantations from the circulation of air, the northerly slope, and the general absence of wet, stagnant land, more than counterbalance the high altitudes of the hill-tops. Where owners can get these favourable conditions they would be well-advised to plant, more particularly if they mix their species.

Aspect and its Effect.—We found considerable variation in aspect, but as a rule land had not been planted with a southern aspect unless with the object of replanting old woodlands or covering a bank. Out of the twenty-seven entries, eleven faced north, north-east or north-west, or principally so, and it is noticeable that out of the eleven prizes awarded seven of them were amongst the plantations with the northerly aspect in spite of the fact that in awarding the prizes credit was given to owners who had been obliged to plant unfavourable sites.

Trees Suitable to Land.—Amongst the various trees included in the plantations we found that the deciduous were represented by oak, ash, beech, sycamore, wych-elm, sweet chestnut, and a few birch here and there. The conifers were chiefly larch, Scots pine, spruce, Douglas fir, Corsican pine, Austrian pine, and a few other varieties in small quantities. In the hardwoods we found that the beech was the favourite tree, and there is no doubt that it was well chosen, for we saw more than one example where it was able to hold its own against other trees in a mixture, and was growing into timber as fast as the larch. We were particularly struck by the vigour of the sycamore upon the Cotswolds. It seems to grow with greater rapidity than any other hardwood, and give promise of being a very useful tree to be used in mixture with conifers. Its merits do not at present seem to be very fully recognised, possibly because it is not valuable in the pole stage; but we found it represented in seven plantations, whereas the beech had been planted in fourteen. On comparing the measurements of the two, the advantage of the sycamore can be seen more clearly. On the oolite in a plantation eleven years old, the beech averaged about 9 ft. high and the sycamore about 17 ft. In another case on a similar soil in a plantation twenty-five years old, the sycamore were about 40 ft. high with a circumference of 19 in., and the beech about 38 ft. high with a circumference of about 10½ in. Again, in a plantation fourteen years old, the sycamore were about 25 ft. in height, and the beech about 18.

Another example of a tree that showed unusual rapidity of growth was the wych-elm upon the Saltmarshe Castle estate. Here the plantation was first commenced about twenty years ago. Five years afterwards some deciduous trees, being culls

from the nursery, were planted amongst the larch. The conifers now average about $13\frac{1}{2}$ in. in circumference and the ash 9 in., but the wych-elm has grown to a girth of about 22 in. The trees are growing on a poor surface soil over the old red sandstone.

Amongst the conifers larch largely predominates, being represented in every entry except one, and it seems as though owners have been right in their judgment in planting these trees, especially as they are in most cases mixed with others and are thriving. Scots pines have been planted in sixteen woods, but very often only a few have been inserted. There are a fair number of instances where spruce has been planted; and, generally speaking, it is doing well and seems to prove that a high altitude is essential to its welfare, and that an elevated dry position is more suitable for it than a low-lying damp situation, which is so often chosen for it. Douglas firs were represented only to a small extent, probably on account of the limestone district in which the greater part of the plantations were found, but trees making very rapid growth were found on the greensand on Sir Henry Hoare's estate in Wiltshire, and a plantation ten years old showed Douglas fir with an average girth of about 11 in. and a maximum of 17 in., whereas the larches which were mixed with them, and were holding their own as regards height, only measured 9 in. as an average, with a maximum of 14 in. In this plantation both Douglas fir and larch were found up to 31 ft. in height—showing a growth of nearly 3 ft. a year—although the average was nearer 24 ft. One of the best examples of rapid growth was found in the pure larch plantation on the Sudeley Castle estate, where some larch, at an altitude of 900 ft., made shoots of 3 and even $3\frac{1}{2}$ ft. last year.

Mixtures and their Results.—It was satisfactory to find that in the great majority of cases the plantations had been formed with trees in a mixture. There were only three examples of what could be termed pure larch, although four or five other plantations were very sparsely mixed with deciduous trees. The reason that actuated the planters for planting trees mixed was not very clear. For the most part their object seemed to be to have ultimately a hardwood plantation, using the conifers as nurses, or else they had put in mixtures with a view to utilising whatever trees showed to advantage, later on. Where plantations were intended ultimately for the growth of conifers, we found hardwoods growing in varying proportions, sometimes so far apart as to be of no practical value.

As a rule the trees were well mixed without any danger of the immediate destruction of any particular type of tree, and in only one instance did we find useless trees planted, nor can

we say, with but few exceptions, that trees unsuited to the situation and aspect had been planted. Even where Douglas and larch had been mixed on the greensand, we found that the latter were holding their own in height, although it may possibly lead to ultimate loss of vigour in the larch.

It was a striking proof of the value of beech in mixture that the only plantation upon the Hatherop Castle estate in which beech had been used was one out of a large area that was chosen for the competition. This mixture of beech and larch—sometimes with other trees, but taking these two as the basis—was the favourite of all. In some cases spruce were added, or Scots pine, and occasionally we found a complicated combination of larch and beech with five or six other varieties.

The proportions varied considerably. In some cases in plantations intended for hardwoods the deciduous trees had been put in as wide apart as 12 ft. by 12 ft., and between that and a proportion of three conifers to one deciduous there were several variations, but the best results will undoubtedly accrue from the plantations where the hardwoods, planted 7 to 8 ft. apart, have not exceeded a proportion of one hardwood to three or four conifers. In the Wolferlow Park plantation of Mr. W. T. Barneby, where the trees were originally planted 3 ft. 6 in. apart, the oaks are in the proportion of one in eight, the ash one in eight, the larch one in two, and other conifers one in four, and the result is all that can be desired. In the part that is sixteen years old, the oaks average about 24 ft. in height and 11 in. in girth, whereas the larch are 22 ft. in height and about 10 in. in girth, but the ash are only about 6½ in. in girth, although able to keep their heads up. In the thirteen-year-old part of the same plantation the oaks are only 6 in. in girth and 21 ft. high, whereas the larch are 10 in. and 22 ft. high, but it is anticipated that the oaks will ultimately regain their lost ground. This is one of the best managed and most promising young plantations that came under our notice.

Although the examples of pure larch were two of the best plantations in the competition, still we feel assured that landowners should in future plant in mixture, and where the ultimate intention is to grow hardwoods they should not exceed the proportion of conifers as stated, and even where the final crop is intended to be conifers, it would be well to put in hardwood trees in the proportion of one in six—or one in eight—and of these hardwoods we especially favour sycamore as an experiment, although we have ample proof of the value of beech.

Planting and Plants.—We have found that the planting work has been done well; the distances have been in accordance

with modern ideas, and for the most part the trees have been put in 3 ft. 6 in. or 4 ft. apart. On the greensand on Sir Henry Hoare's estate the trees were planted 5 ft. apart, but it has been no detriment whatever to them, probably owing to the sheltered position of the plot and the deep, moist, sandy soil, which have caused a very rapid growth and counteracted the usual baneful effects of such thin planting. On the other hand, we found one plantation of 5 ft. intervals and another 4 ft. by 6 ft., in both of which the ultimate growth has shown that it was a mistake. The average of all the distances is almost exactly 4 ft. by 4 ft., and this may be taken as a very good distance for the oolite district and even for the old red sandstone.

The age of the trees when planted varied from two to five years, though there was only one example of the former. For the most part the conifers were put in at three years old, and the hardwoods at four, and these average ages having produced —so far as we saw—the best plantations in the district, may be taken as suitable. As a rule the trees had been once transplanted, but we found in one instance that three-year-old conifers, which had been twice transplanted, formed an excellent plantation. The one or two cases in which the trees had been five years old gave every evidence that the extra year was a mistake.

In practically every case the trees had been "pit"-planted, although we found a modification in two plantations where the rows had been first struck out with a plough, and another example in which the hardwoods were "pitted" and the conifers "notched." In the course of our work we were told that it was very essential to start the trees well upon the oolitic limestone, and if they once got a firm hold they would thrive; and we feel sure that this is worthy of every consideration, and that cheap work is the greatest mistake upon this soil. The fact that in almost every plantation the trees have been pitted, and the regularity of the rows giving evidence of careful workmanship, point to the fact that the plantations which have produced the best results are those in which special care was taken in starting them.

The first cost has necessarily been very varied, and on the whole we do not feel that the figures given to us can be altogether relied upon, as many owners or their agents had no records, and the figures were merely estimates, in some cases founded upon more modern work. The cost of plants and planting, however, varied from 5*l.* to 12*l.*, and an average may be taken at 7*l.* 5*s.*, estimating the value of the trees at 20*s.* per 1,000 where they have been home-grown, or the original cost is not known. This cost is exclusive of all rabbit-netting

or external fencing, and although it may be considered somewhat high, we do not think that owners planting—more particularly in the oolite limestone district—can look forward to a good result unless they are prepared to expend a sum approaching this figure upon the work. We may say that the beneficial result that accrues from good work is clearly shown in the fully-stocked plantations shown to us, many of which had scarcely been touched since they were first planted except for weeding and cleaning, and in some it was possible to go through long rows without finding a missing tree.

In most cases the young plantations were netted against rabbits when first planted. We find the mixed mesh netting was used here and there, but for the most part 3 ft. 6 in. netting with a 1½-in. mesh had been adopted successfully. There seems to have been a tendency to take away the netting too soon, but it was explained by more than one agent that the number of rabbits had increased considerably after this was done. We find as a rule that active steps have been taken to keep down rabbits, but apparently these efforts are of rather recent date, although it is encouraging to find owners waking up to the serious damage caused by rabbits to their woodlands, and realising that rabbits and young trees cannot be grown profitably on the same ground concurrently. The details of other fencing do not afford any information of much value, except that we were shown an excellent quick hedge made from the thorns dug out of the area before it was planted, and we noticed the error on one property of planting the trees too near the newly-formed hedge, which has subsequently become overgrown by the spreading branches and consequently damaged.

This damage to external hedges has been overcome on one or two estates by the excellent plan of having a broad ride all round the outside of the trees. But this has only been done on estates where attention has been paid to the important question of woodland rides. It does not appear to have occurred to some owners how much they can improve the value and appearance of their estates, and at the same time facilitate the clearing of their timber, by leaving wider rides. One of the best examples of woodland rides was that of Mr. Dent Brocklehurst, whose larch plantations lie upon undulating land at a very high altitude, and who has materially improved the value of his property by the judicious planting and excellent planning of a considerable area of land of small value. Another instance of good planning was that of Mr. Barneby in the Wolferlow plantation. In this case the whole of the 100 acres was planned out before the work was

commenced, and curved rides 20 ft. and 30 ft. wide were made intersecting the plantation in different directions. A third example, which is well worth comment, is that of the Michaelwood Chase, the property of Lord Fitzhardinge, where 100 acres have been systematically planted over a period of years upon a definite ground plan, including good wide rides, with excellent result. On the other hand, we found properties where the question of woodland rides and estate planning had been absolutely disregarded ; and even worse than this, cases in which the owner had planted up the best land, and where difficulties of soil were encountered, had left those places waste. This is surely a discredit to the estate, and such as would certainly counterbalance any improved capital value, which would necessarily arise from a good plantation on a waste area, apart from the value of the timber.

Management and Thinning.—Competitors were asked to furnish particulars of expenditure upon the plantations for the first four years, and although several could give details only with difficulty, we found that, as a rule, the plantations were brushed up and blanks were filled in at what might be taken as an average cost of about 20*s.* per acre altogether. We consider there is a decided tendency to thin too early, and in more than one case the effects of such work carried out in the past are still apparent, and will not be remedied for some years. We found that some owners had trimmed up their plantations before the side-branches had died back, and as this same error is still being committed, owners would do well to point it out to their agents and foresters and take the lesson to heart. We saw no plantation which was suffering because it had not been sufficiently thinned, and although it was doubtful in one case whether the worst trees had been cut out, we always found that those responsible for the woodlands were well acquainted with the main principles of cutting out the dead and suppressed trees and leaving the best to grow into timber. We came across only two examples of the old-fashioned method of thinning by cutting out alternate rows, but in both cases we were told that this had been abandoned, and we may take it that this objectionable practice has been superseded generally by the more enlightened policy of removing the worst and suppressed trees.

Insects, Fungi, and Game.—The most serious pest of which we found traces was the *Argyresthia lævigatella*, which appears to have done a considerable amount of damage to the larch plantations on the Cotswold Hills in the last two years. In addition to this, we found examples of the larch-miner (*Coleophora laricella*) and larch-aphis (*Chermes laricis*), and there were one or two cases of damage in the past from the

pine-shoot tortrix (*Retinia buoliana*), although there are no recent signs of it.

The only serious fungus was the larch blister (*Peziza Wilkommii* [*Dasyscypha calycina*]), although the high altitudes and the generally dry soil were not favourable to its growth, and the plantations of the Cotswold Hills were, on the whole, remarkably free from any disease. We found the worst specimens upon the greensand and on parts of the red sandstone, especially in places liable to be affected by late spring frosts. As a rule, no attempts had been made to combat the disease, but one area had been thinned and partly replanted, and we found a case where the trees had been treated with caustic soda, and yet another, that of Mr. H. J. Marshall, of Gayton Hall, where the canker had been dressed with coal-tar and creosote, which had proved effective.

Damage by rabbits, on the whole, was not serious, and in the one case in which they have occasioned much loss, it was quite apparent that they were unnecessarily numerous and might still be kept down to a lower level. Squirrels were responsible for a small amount of damage, but they had been shot as soon as the damage was discovered.

Statistics of Measurements.—The plantations varied in age between six and twenty-eight years inclusive. The average measurements of the larch are approximately as follows:—

Age	Length	Girth	Age	Length	Girth
Years	Feet	Inches	Years	Feet	Inches
6	9½	—	18	26	12½
7	12½	5	19	41	13
8	10	5½	20	30	13½
9	15	—	21	35	13½
10	19½	8	22	—	—
11	22	9½	23	—	—
12	—	—	24	33	12
13	24	9½	25	43½	22½
14	31½	13	26	—	—
15	—	—	27	45	22
16	22	10	28	46	22
17	—	—			

In these figures the rapid growth of the trees aged fourteen years is due to heavy thinning in a plantation badly attacked by larch blister; soil, stone-brash on oolite limestone; elevation 530 ft. The slow growth shown for the trees aged twenty-four is partly due to the fact that they are just fit for thinning, and the small trees reduce the average, but the trees are on inferior oolite at an elevation of about 800 ft.

Comparing the larch with the other trees, we get the following approximate average sizes :—

Age	Larch		Beech		Ash		Sycamore	
Years	Length, Feet	Girth, Inches	Length, Feet	Girth, Inches	Length, Feet	Girth, Inches	Length, Feet	Girth, Inches
6	9½	—	6	—	4	—	—	—
11	22	9½	9	—	14	—	17	—
16	22	10	17	6	22	6	28	9½
21	35	13½	24	8	33	9½	34	15
26	44	22	36	11½	—	—	—	20

Age	Oak		Scots Pine		Wych Elm	
Years	Length, Feet	Girth, Inches	Length, Feet	Girth, Inches	Length, Feet	Girth, Inches
6	—	—	9½	—	—	—
11	15	—	16	—	—	—
16	24	11	20	10½	—	—
21	—	—	—	—	34	21
26	—	—	—	—	—	25

Particulars of the various awards made in the competition will be found in the Appendix, pp. cxiv. and cxv.

Although we were not able to recommend an award to No. 23 (the only entry in Class 26), as it is a coppice in process of being turned into a high forest, and, therefore, not a plantation in the strict sense of the word, yet we consider great credit is due to Mr. M. P. Price and his young woodman for the excellent results so far achieved. The coppice-shoots are now twenty-eight years old, with a few oak standards apparently twice that age or a little more, but not with extra-spreading tops, and the wood is fully stocked with straight-stemmed oak and ash in a very healthy condition. It had been allowed to grow untouched for twenty years, and then it was carefully thinned, and two to four stems left on each stool, so as to preserve the overhead canopy as much as possible. As time goes on the number of stems on the stools will be reduced to one, and the weakly and suppressed ones cut out altogether. The only improvement that might be suggested would be to underplant (after next thinning) with beech and sycamore, to prevent the growth of adventitious shoots on the boles of the oaks.

Judges { W. B. HAVELOCK.
LESLIE S. WOOD.

June, 1909.

FARM PRIZE COMPETITION, 1909.

THE Farm Prize Competition, held in connection with the Society's Show at Gloucester, covered the large area of the four counties of Gloucester, Wilts., Hereford, and Worcester, and afforded a greater diversity of classification than has formerly been the case.

The following prizes were offered by the Gloucester Local Committee for the best managed farms in Gloucestershire and Wiltshire :—

CLASS I.—Farms of 300 acres or over, chiefly Arable, exclusive of Down. First Prize, 100*l.* Second Prize, 50*l.*

CLASS II.—Farms of 50 acres or over, and under 300 acres, chiefly Arable. First Prize, 50*l.* Second Prize, 25*l.*

CLASS III.—Farms of 200 acres or over, chiefly Pasture, exclusive of Down. First Prize, 50*l.* Second Prize, 25*l.*

CLASS IV.—Farms of under 200 acres, chiefly Pasture. First Prize, 30*l.* Second Prize, 15*l.*

Prizes were offered by the Herefordshire and Worcestershire Agricultural Society for the best-managed farms in Herefordshire and Worcestershire :—

CLASS V.—Farms of 200 acres or over, Arable and Pasture. Firs Prize, 60*l.* Second Prize, 30*l.* Third Prize, 15*l.*

CLASS VI.—Farms of 50 acres or over, and under 200 acres, Arable and Pasture. First Prize, 40*l.* Second Prize, 20*l.* Third Prize, 10*l.*

CLASS VII.—Farms of over 50 acres, of which not less than 20 per cent. is under Hops and Fruit. First Prize, 60*l.* Second Prize, 30*l.* Third Prize, 15*l.*

CLASS VIII.—Farms of 10 acres or over, and not exceeding 50 acres, chiefly devoted to Fruit Growing and Market Gardening. First Prize, 20*l.* Second Prize, 10*l.* Third Prize, 5*l.*

An entry fee of 1*l.* was charged to members of the R.A.S.E., Gloucestershire, Herefordshire and Worcestershire, and Berkeley Hunt Agricultural Societies, and the Beaufort Hunt Farmers' Club. To non-members of any of the above-named societies the entrance fee was 2*l.*, with the exception of Class VIII., in which class the entrance fee was 10*s.* to members, and 1*l.* to non-members. The competition was limited to tenant farmers, paying a *bonâ-fide* rent for at least three-fourths of the land in their occupation. Farms situated partly in one and partly in the other of the areas of the competition might be entered in either of the classes for which they were eligible. In the case of a border farm being partly in one of the above-mentioned counties and partly in an adjoining county not included in the competitions, such farm was eligible, provided at least one-half of the land were situated in the areas of the competitions. In assessing the proportion of arable and grass land on the occupations, "down" land was not considered. All land that had been down

to grass for ten years was considered as permanent pasture. Competitors were required to enter for competition all the land in their occupation, and to have occupied it for not less than two years. Due notice was taken of any cases in which the competitor acted as agent for his landlord, thus having a controlling influence over important factors of farm equipment.

The Judges were instructed to withhold the prizes in the absence of sufficient merit, and were requested especially to consider: (1) General management, with a view to profit; (2) productiveness of crops; (3) quality and suitability of live stock, especially that bred upon the farm; (4) management of grass land; (5) state of gates, fences, roads, general neatness, and state of cottage or cottages, so far as tenant is liable; (6) mode of book-keeping followed, if any; (7) management of the dairy and dairy produce, if dairying pursued; (8) management of orchards, fruit plantations, and hop-yards; (9) duration of the tenancy.

The cost of judging the farms was borne by the Royal Agricultural Society, who appointed the following Judges:— For Classes I. (21 entries), II. (5 entries), III. (13 entries), IV. (8 entries), all in the Gloucestershire and Wiltshire area, Mr. Joshua Ball, Southworth Hall, Warrington, and Mr. T. S. Minton, Montford, Shrewsbury. For Classes V. (15 entries), VI. (10 entries), VII. (3 entries), all in the Herefordshire and Worcestershire area, Mr. H. A. Peto, Park Farm Office, Woburn, and Mr. Warwick Stunt, The Shrubbery, Frindsbury Hill, Rochester. There were no entries for Class VIII.

The writer was appointed to act as Secretary.

The first visit of inspection in all classes was made during the month of February, with the result that the Judges decided to re-visit the following competitors only:—In Class 1 (Gloucestershire and Wiltshire)—Mr. Harry Butler, Badminton, R.S.O.; Mr. James T. Hobbs, Maisey Hampton, Fairford; Mr. Alexander Iles, Park Farm, Fairford; Mr. G. H. Jones, Little Badminton, Chippenham; Mr. John Parsons, Barford Farm, Downton, Salisbury; Mr. G. Caines Waters, Burcombe Manor, near Salisbury. In Class 2 (Gloucestershire and Wiltshire)—Mr. James Gardner, Chesterton Farm, near Cirencester; Mr. Henry Matthews, Down Farm, Winterbourne, Bristol; Mr. William Matthews, Wick-Wick Farm, Winterbourne, Bristol. In Class 3 (Gloucestershire and Wiltshire)—Mr. Henry Bridgman, Cleve Hill Farm, Downend, Bristol; Mr. Charles Cornock, Hillesley, Wotton-under-Edge; Mr. B. Dudfield, Frampton, Toddington, Winchcombe; Mr. R. M. Rowles, Showell Farm, Lacock, Chippenham; Mr. John G. Rymer, Apperley, Tewkesbury. In Class 4 (Gloucestershire and Wiltshire)—Mr. W. P. Hill, Moorend Estate Farm, Slimbridge,

Stonehouse; Mr. W. McEwen-Smith, Westmoreland Farm, Henbury; Messrs. C. Pendock and Sons, Mangotsfield. In Class 5 (Herefordshire and Worcestershire)—Mr. Thomas Andrews, Stretton Court, Hereford; Mr. H. R. Evans, Court of Noke, Staunton-on-Arrow; Mr. Francis Hawkins, Sugwas Farm, Swainshill; Mr. John Pratt, Stourport; Mr. John Rawlings, Woofferton, Brimfield, R.S.O. In Class 6 (Herefordshire and Worcestershire)—Mr. George Brooke, Severn Stoke; Mr. George Tilt, Lodge Farm, Hanley Castle, near Worcester; Mr. Walter Meek, Great Buckman's Farm, near Malvern. In Class 7 (Herefordshire and Worcestershire)—Mr. G. H. Bray, Dormington Court, Hereford; Mr. F. P. Norbury, The Nonest, near Malvern; Mr. H. T. Nott, Kyrewood, Tenbury.

The second tour of the farms in Gloucestershire and Wiltshire was made towards the end of May, a third visit being paid to a few closely contesting farms just before the Show in June. The farms in Herefordshire and Worcestershire were inspected in June and no third visit was necessary.

The competition in Class 1 was very good and keen, rather weak and disappointing in Class 2, good in Class 3, fairly good in Class 4. With regard to Herefordshire and Worcestershire the competition in Class 5 was very good and close, very weak in Class 6, and excellent in Class 7.

The Judges' awards were handed to the Secretary of the R.A.S.E. and announced at the meeting of members in the Showyard on the Thursday of the Show week.

They were as follows:—

Class I.—First Prize of 100*l.* to Mr. G. Caines Waters. Second Prize of 50*l.* to Mr. Harry Butler. Very Highly Commended, Mr. James T. Hobbs. Highly Commended, Mr. Alexander Iles and Mr. G. H. Jones. Commended, Mr. John Parsons.

Class II.—First Prize of 50*l.* to Mr. William Matthews. Second Prize of 25*l.* to Mr. Henry Matthews.

Class III.—First Prize of 50*l.* to Mr. Benjamin Dudfield. Second Prize of 25*l.* to Mr. John G. Rymer. Highly Commended, Mr. Henry Bridgman and Mr. Charles Cornock. Commended, Mr. Robert M. Rowles.

Class IV.—First Prize of 30*l.* to Mr. William P. Hill. Second Prize of 15*l.* to Messrs. Charles Pendock & Sons. Highly Commended, Mr. William McEwen-Smith.

Class V.—First Prize of 60*l.* to Mr. Francis Hawkins. Second Prize of 30*l.* to Mr. Thomas Andrews. [1] Third Prize of 15*l.* to Mr. John Rawlings. [1] Reserve Number and Highly Commended, Mr. H. R. Evans.

Class VI.—First Prize of 40*l.* to Mr. George Brooke. Second Prize of 20*l.* to Mr. Walter Meek. Third Prize of 10*l.* to Mr. George Tilt.

Class VII.—First Prize of 60*l.* to Mr. H. T. Nott. Second Prize of 30*l.* to Mr. George Bray. Third Prize of 15*l.* to Mr. F. Paget Norbury.

[1] It was subsequently ascertained that the farm of Mr. John Rawlings did not strictly conform with the conditions of entry. The third prize was therefore awarded to Mr. H. R. Evans.

Class I.—First Prize Farm.

Occupied by Mr. G. Caines Waters, Burcombe Manor, near Salisbury.

This farm is held on a yearly tenancy under the Earl of Pembroke, and consists of about 750 acres, made up of 392 acres arable, 50 acres pasture, 50 acres water meadows, and for the rest, down land, homestead, and a small orchard.

The soil is a light loam, with chalk subsoil. It is not rich soil, and must only be ploughed to a depth of three or four inches on account of the subsoil, which would convert the friable land into an impossible seed-bed. It is essentially sheep land, which under a good and well-managed flock and careful cultivation will produce good results. Both of these conditions obtain at Burcombe Manor Farm.

The tenant is not bound to any prescribed form of cropping, but is under agreement not to crop more than half of the land with corn in any one year. Of the arable land, 332 acres (of which 83 are in one field) are worked on a four-course system:—

"Seeds" — Roots

Roots — Roots

Wheat

Barley (or Oats)

"Catch Crops" — "Seeds"

Roots — Roots

Wheat.

Starting with the wheat crop—half of this is taken after clover "seeds" mixture which has been "hayed" once, grazed, and followed by turnips which are eaten on; the other half being after a double crop of roots, also fed on. Barley or oats follow wheat. Half of the barley or oat area is undersown with clover "seeds" mixture, the other half being used for catch cropping, commencing with rye (April), followed by Italian rye-grass (May), followed by vetches (June and part of July). Roots follow on both the clover ley land and the "catch crop" land, and then we come again to wheat. The other 60 acres of arable land are up on the adjoining Down, and are known as "Beak" land. Here oats are grown alternately with turnips, 20 acres being set apart for each crop; the

remaining 20 acres being in sainfoin, which is cut for hay and continues for some six or seven years. The area under the various crops on the 392 acres of arable land in 1909 was as follows:—Wheat, 82 acres; barley, 70 acres; oats, 32 acres; root crops, 101 acres; "catch crops," 42 acres; clover "seeds," 42 acres; sainfoin, 20 acres; lucerne, 3 acres. The clover "seeds" mixture which is sown under half of the barley or oat crop consists of 10 lb. broad red clover, 4 lb. alsike clover, and ½ bushel of Italian rye-grass per acre. This yields about 25 to 30 cwt. of hay.

The second growth of clover is fed off with sheep, but occasionally 10 acres are saved for seed. In the following spring the clover ley is manured with sixteen to twenty loads per acre of farmyard dung, which is ploughed in for the turnip crop. The turnip crop also receives 3 cwt. per acre of superphosphate. The roots are folded on by sheep receiving cake and corn. Wheat follows the turnip crop, and is not especially manured. Meantime the other half of the barley and oat land which had not been undersown with seeds has been cropped with 6 acres of rye, 16 acres Italian rye-grass, and 20 acres winter vetches. Pitted swedes and mangolds are hauled out over the rye, and Italian rye-grass when being fed off, to the extent of five loads of each per acre. Afterwards, all the ground which had been in rye, Italian rye-grass and vetches, as soon as fed off, is put into swedes. Wheat is followed by barley or oats, and here again no manure is necessary, as after such folding by stock as is practised on this farm, any application of forcing manures would probably only mean "lodged" crops. The state of the land under this form of cropping was seen to be perfectly clean and full of condition. Average yields of the corn crops are, per acre: wheat, 5 to 6 quarters; barley, 5 to 5½ quarters; oats, 7 to 8 quarters.

Lucerne is grown, and yields heavy crops of green fodder for the horses, and remains down for a considerable period, lasting as long as nine years in some instances.

As has already been stated, most of the manuring of this farm is done, and done well, through the stock, but in the case of the root crops grown for the folding of stock, manure has of course to be given. Thus turnip crops are manured with fifteen to twenty loads of dung and 3 cwt. superphosphate per acre, the "swedes" receiving in addition 4 cwt. per acre of special "Swede" fertiliser. The mangold crop gets twenty loads of dung, and either 4 cwt. guano or 4 cwt. "mangold" manure per acre, also 5 cwt. of salt and 1 cwt. nitrate of soda per acre, given in two dressings. All turnip and swede seed is steeped in paraffin, to guard against an attack of the turnip "fly," a method in which Mr. Waters has great faith.

The 50 acres of pasture is of rather inferior quality, but is well grazed by the heifers and cow stock, and receives the liquid tank manure from the cows and horses. The 50 acres of water-meadows are kept for the sheep and the dairy herd. One-third of the area is grazed by the sheep in the spring while folding on the rye and Italian rye-grass, and the other two-thirds by the dairy cows in the earlier part of the year, and the cows continue to graze the meadows all the summer.

As soon as the feeding of the water-meadows is finished in the autumn, the "drowner" commences working up the meadows, trimming grass, shovelling out mud from the waterways and drains, and making good with turf any uneven places which may have been caused by cattle treading. The hatches are then drawn and sufficient water let down to run evenly over the beds. The water is allowed to run over the meadows continuously for about fourteen days, after which it is shut out for about seven days. This course is followed throughout the winter, and in ordinary seasons there is sufficient grass on to which to turn the cows and sheep by March 25. Should frosty weather or very cold cutting winds occur, it is absolutely necessary for the water to be kept running over the grass to protect it from the frost and wind.

The water is shut off from the meadows about a fortnight before grazing commences, so that the meadows become firm and the grass hardened. As soon as the grass is fed off, the water is put over the meadows again, and they are fit for further grazing in six weeks' time, and so the process continues through the summer.

Horses.—There are thirteen working horses, all bought as geldings, at from four to five years old. The horses were good and suitable for their work. Occasionally a horse is sold for town work. Their ration consists of oats, at the rate of 2½ bushels per horse per week, and hay. Half-a-pint of linseed gruel per horse is given each night with the food as a preventive against colic. During summer the horses have lucerne instead of hay.

Cattle.—The cattle consist of forty cows in milk, ten dry cows, ten two-year-old heifers, ten one-year-old heifers, twelve calves, and two stock bulls, all of the Shorthorn type, the bulls being selected from milking strains. All the stock is home-bred, with the exception of the bulls. Most of the calves are sold, only about ten of the best heifer calves being retained each year to keep up the herd. During winter the cows have per head from 50 to 60 lb. pulped mangold and chaff, 3 lb. undecorticated cotton cake, and 3 lb. of either decorticated cotton cake or soya bean cake. From April to October the cows are on the water-meadows. The herd is tested from time

to time, and unsatisfactory cows rejected. The milk all goes to London, and, throughout the year, averages $8\frac{1}{2}d.$ a gallon, which includes $1d.$ per gallon for carriage, paid by Mr. Waters.

Sheep.—The flock of registered Hampshire Downs consists of :—

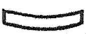
149 Two-teeth Ewes	4 Rams
162 Four-teeth Ewes	170 Ewe Tegs
135 Six-teeth Ewes	
24 Over-age Ewes	
470 Ewes	

and, later, 626 lambs. The flock was established in 1896 by purchases from the best known breeders, and has met with considerable success at the fairs and in the competitions organised by the Hampshire Down Sheep Breeders' Association. In the Association Flock Prize Competition the second prize was secured, 131 per cent. of lambs to ewes having been reared and only six ewes lost—a very creditable result. At the Salisbury Fair of 1908 this flock took first prize for 100 regular draft ewes, first for 100 shearling ewes, and first for wether lambs. The ram lambs saved this season numbered 85, and averaged seven guineas each at the fair.

Management of the Hampshire Flock—The rams are put with the ewes on August 8, from which date the first lambs are expected to fall on January 1. About ten to fourteen days before the rams are put out the ewes are given fresh folds of rape and turnips to flush them, after which they are drawn in flocks of from 80 to 100, and a ram, of the character and style likely to produce the ideal Hampshire type, is put with each lot and remains until they all have been mated. The ewes are all given a distinctive mark with paint, to show with which ram they have been mated, and at lambing time the lambs are all notched in the ears, so that their pedigree may be known. The ewes are allowed such quantity of turnips as they will clean up daily, with the run of the grass down until November 1. At this time hay is given at the rate of from $1\frac{1}{2}$ to 2 lb. per head, the turnips reduced to two or three roots per head, and the ewes allowed a run out on the down daily. This continues until within fourteen days of lambing time, when the addition of $\frac{1}{2}$ lb. per head per day of linseed cake, with a small fold of grass, is allowed. This allowance keeps the ewes healthy and considerably assists the quantity and quality of the milk. It is an important principle not to allow the ewes any swedes until they have lambed. After lambing, the ewes with twins are given 1 lb. per head, and the ewes with single lambs $\frac{1}{2}$ lb. per head of linseed cake and cotton cake, mixed in equal proportions. This continues until the lambs

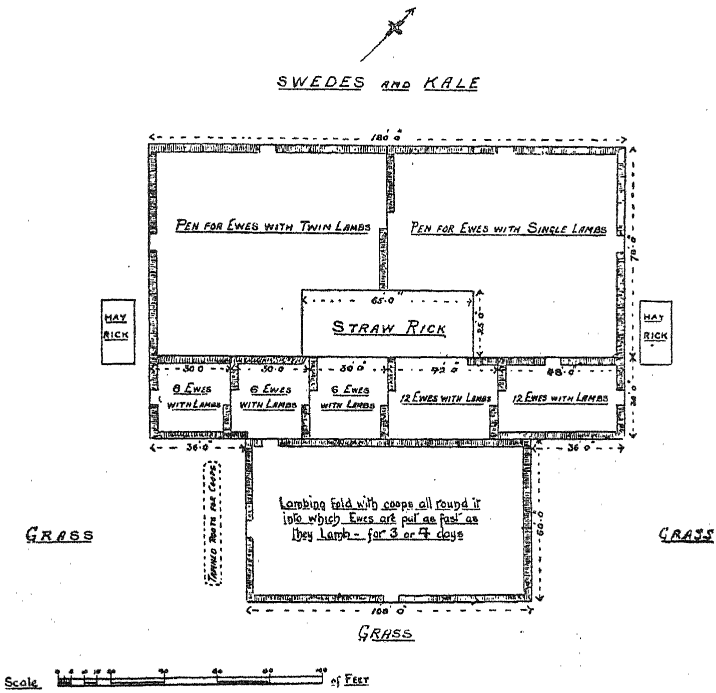
are weaned, about the middle of May, at which time the lambs will be eating 1 lb. per head of a mixture of linseed cake, split beans, split peas, and locust bean meal. The lambs have the run of the front fold of roots from the time they commence to eat until they are weaned, care being taken to have them shut back in the fold at night to prevent them eating any green food while the frost is on it. Cribs of fresh hay are put in the folds for the ewes each morning and afternoon. As soon as the lambs are weaned the ewe lambs are taken out from the ram lambs and given ¾ lb. of a mixture of equal parts linseed cake and cotton cake. The ram lambs are then examined and the faulty ones castrated and sold early in July, many weighing from 8 to 9 butcher's stones (64 to 72 lb.) each.

The ram lambs are allowed such quantity of mixed linseed cake, split peas and beans, and locust bean meal as they can eat, which is about 2 lb. per head per day, with rye or Italian rye-grass, vetches or rape or cabbage (catch crops), which are fed off in rotation after the swedes and kale are finished towards the end of April. The lambs have cake until they go, and the ewes until after they are shorn, when the lambs are weaned. Ewes are always allowed access to water at all seasons of the year. Rock salt is always supplied for all sheep. The regular draft ewes are sold at Salisbury Great Fair in July, and the ram lambs at Britford Fair, August 12, and Wilton Fair, September 12.

The situation of the lambing pen is carefully considered beforehand, and is immediately connected with the cropping of the land so as to ensure the proximity of grass, straw, roots, and hay. The actual site is chosen early in the year and the hay and corn stacked thereon. The wheat rick is so placed that when threshed the straw stack will be in the centre. The plan of the lambing pen will show how the ewes and lambs are worked through the pen. The hurdles are 6 ft. long and 3 ft. 6 in. in height. They are "wattled" hurdles made of hazel wood by one of Mr. Waters' men. They are made on a wooden lath slightly curved  so that the hurdles become tighter as they are straightened in use. The hurdles are supported by stakes driven into the ground.

To construct the lambing pen the folds are measured out and wheat straw put down about 3 or 4 in. in thickness, on which hurdles are set up. Another lot of hurdles are then set up alongside the first and straw put between them. Piles and rails are then put up about 2 ft. from the upright hurdles, and hurdles laid on top of the rails to reach the upright hurdles, after which they are thatched and sewn down with string and green rods. The farm is well

supplied with good buildings and cottages, towards the upkeep of which the tenant pays half the cost of the labour, the landlord finding material and half the labour. This arrangement applies also to gates and drainage. The tenant is entirely responsible for the upkeep of the farm fences and roads. Mr. Waters has kindly supplied the following items of annual expenditure:—Labour, 830*l.*; purchased foods, 976*l.*; manures,



115*l.* The labour on the arable land works out at about 1*l.* per acre. Piece work prices include: hoeing—turnips, 6*s.*, swedes, 7*s.*, mangold (three times) 20*s.* per acre; layering thorn hedges, 6*d.* per rod. "Stooking" corn is paid for at the rate of 1*s.* per acre. At hay time 3*s.* per day is given and at harvest time 4*s.* Twenty labourers are employed, including special labour such as attendance on the flock and dairy herd.

This farm appealed to the Judges in every particular. That here was an all round good state of affairs was strikingly evident. Good and economic management, good crops, perfectly clean land, full of condition, good home-bred stock of the right kind, a state of general neatness and complete equipment, a well-managed dairy, all bore testimony to a farm

conducted on up-to-date principles in a business-like manner. It says much for Mr. Waters' thoroughness that the Judges failed to find twitch or charlock.

The Judges had no hesitation in awarding to Mr. Waters the first prize of 100*l*. in Class 1.

Class II.—First Prize Farm.

Occupied by Mr. William Matthews, Wick-Wick, Winterbourne, Bristol.

This farm belongs to W. B. Wilberforce, Esq. and Dr. Basil Harwood, and consists of 148 acres arable and 73 grass. The soil on the lower portion is clay, with a little marl and loam, on the higher land it is stone-brash. The rotation of cropping is—

Wheat or oats
|
Clover
|
Wheat
|
Roots or catch-cropping
|
Wheat or oats.

Beans are sometimes grown and follow wheat. Sainfoin is grown for fodder and for hay, remaining down for some years. It is then ploughed in and followed by oats unless "foul," in which case it is "fallowed." Barley follows roots on the stone-brash. The catch crops are selected from: (*a*) Trifolium sown on the wheat stubble during August or early September for spring feed for sheep; (*b*) stubble turnips after an early harvest—either of these followed by (*c*) vetches, (*d*) rape, or (*e*) kale, all folded on the land. Sometimes turnips are taken after trifolium, in which case the land goes into oats. It was pointed out to the Judges that on light soils it is not easy to grow turnips after trifolium, because the latter leaves the land very dry. The crops this year include wheat, 50 acres; oats, 4 acres; beans, 5 acres; clover, 19 acres; vetches, 9 acres; mangolds, 7 acres; roots, 10 acres; potatoes, 2 acres; sainfoin, 12 acres.

The clover mixture used consists of 9 lb. broad red clover, 3 lb. alsike clover, 2 lb. trefoil, and ½ bushel Italian rye-grass per acre. The seeds are rather thin and poor. The tenant has laid down all the 73 acres of permanent grass. This is on the solid clay, which did not pay under the plough. Only 35 acres, however, could be considered by the Judges as permanent, the other 38 having been so recently sown as to come within the schedule of "arable" land. The grass

seeds were obtained from a firm of high repute, and the mixture was as follows:—2 lb. foxtail, 6 lb. cocksfoot, 3 lb. hard fescue, 2 lb. tall fescue, 2 lb. sheep fescue, 6 lb. meadow grass, 5 lb. timothy, 5 lb. red clover, 4 lb. white clover, 3 lb. alsike clover, and 2 lb. sheep's parsley per acre. When asked if he would use the same mixture again, Mr. Matthews replied that he would leave out the cocksfoot, which grows very coarse on his land. The pasture land is treated with 5 cwt. per acre of basic slag from time to time, with good results. The hay land receives annually 12 tons per acre farmyard manure and 5 cwt. superphosphate. About 40 tons of "night sweepings" are obtained each year and distributed over the grass land generally.

Mr. Matthews' idea is to grow as much wheat and straw as possible, and produce to supply his dairy herd and other stock. Selling milk and corn-growing are the chief sources of income, and as many sheep are kept as will dress the land and go off fat. The system of manuring is to dress the land for the white crops as well as possible by cake-fed sheep folded on the catch crops and roots, the root crops in their turn being liberally supplied with farmyard and town stable manure. About 150 tons of town stable manure is brought on to the farm for the root crops each year, and the arrangement for the supply of this is interesting. Wheat straw is sold to Bristol stables about five miles distant at 50*s.* per ton delivered, and stable manure is bought back at the rate of 3*d.* per horse per week. All crops receive a supplementary dressing with artificial fertilisers whenever necessary or advisable. Wheat is given a dressing of 8 cwt. of soot per acre when the land requires help. Mangold get, per acre, 24 tons of mixed farmyard and stable manure, 1¼ cwt. sulphate of ammonia, 2 cwt. kainit, and 3 cwt. superphosphate. The mangold are drilled in rows 20 in. apart, and the plants are "singled" at 8 in. apart. Heavy crops of uniform roots are obtained. The mangold plant was exceptionally good and the land perfectly clean. Swedes are given 14 tons per acre mixed manure, 3 cwt. dry vitriolised bones, and 3 cwt. superphosphate. Two ploughings are given for mangold and four for swedes. The depth ploughed for mangold is 6 in., for swedes 5 in., for wheat 6 in., for barley 5 in., for oats 6 in. The best wheat seen was after trifolium (fed on), followed by vetches (also fed on). This was an excellent piece of wheat, well "tillered." The clover ley wheat was good, but not so good as the wheat following catch-cropping. Mr. Matthews is a great believer in change of seed corn and buys the best obtainable each year.

The horses consist of seven working horses, two "milk" horses, two colts, and one nag horse. They lie out at grass

at night during the summer. Winter and summer the working horses have a mixed ration consisting of 7 bushels oats, 1 sack sharps, and 1 sack bran per week amongst the seven of them, a little more being given them when working very hard. They are of the Shire type and are just useful working horses.

Mr. Matthews is under contract to supply 50 gallons of cold milk daily, to be delivered 2½ miles from home, at a price which averages 7*d.* per gallon for the summer months and 8*d.* for the winter months. For this purpose thirty dairy cows are kept. During summer when at pasture the cows receive per head 3 lb. cotton cake. The winter ration consists of ½ cwt. mangold, 3 lb. mixed bean and barley meal, 2 lb. cotton cake, 2 lb. sharps, and 1 lb. linseed cake per head, with as much chaff and hay as they will clean up. This ration is for cows in full milk, and is afterwards slightly reduced. Approximately equal milking is practised during summer, viz., at 6 a.m. and 5 p.m. During winter milking takes place at 6 a.m. and 4 p.m. Seven or eight calves are weaned each summer when the milk is plentiful, and these are kept to go into the dairy herd. The sheep were all bought in, and comprised ten ewes, fifty tegs, and forty lambs. They are bought in for the purpose of folding on the catch crops and roots land and being sold off fat. The corn and cake supplied to the young sheep is half-and-half split beans and linseed cake. The ewes receive ½ lb. Egyptian cotton cake and ½ lb. linseed cake. Three breeding sows are kept. After leaving the sow the young pigs are fed up on sharps and beans, and sold at five or six months old.

The tenant is responsible for fences and occupation roads, and these were in good order.

Artificial manures cost 25*l.* per annum; purchased foods amount to 305*l.* per annum, and labour to 320*l.*

Hoeing mangolds and turnips is paid for at 12*s.* per acre—twice over—the third hoeing, if necessary, being done by day work. Ditching is done at 2*d.* or 3*d.* per perch, and hedge layering at 6*d.* to 1*s.* per perch.

This farm is characterised by perfectly clean land, good cultivations, healthy crops, and economical management all round, all of which are productive of good results.

Class III.—First Prize Farm.

Occupied by Mr. Benjamin Dudfield, Frampton Farm, Toddington, Winchcombe, Gloucestershire.

This farm is held on a yearly tenancy under Hugh Andrews, Esq., and has been occupied by Mr. Dudfield for

thirty years. It may be described as a poor hard-working clay farm, full of condition and showing good management all round. The tenant is not under any restrictions as to cropping. There are 70 acres of arable land and 422 of pasture, 60 of which have been sown down recently. The soil is a heavy clay, particularly the vale land, which requires four and five horses to plough it, and half an acre per day is good work. On the hill it is "three-horse" land. The rotation of cropping is as follows :—

Vale land	Hill land
Fallows	Roots
Beans	Barley or oats
Wheat	Seeds
(Barley sometimes)	Wheat.
Clover	
Wheat	
Fallows.	

The vale land fallows are ploughed as many times as can be managed, Mr. Dudfield being of opinion that the plough is the best kind of "scuffle" on his land.

Beans are manured with 15 tons per acre of farmyard dung, and yield from 40 to 50 bushels per acre. Wheat is seldom manured in any way. Square Head's Master is the variety sown, and should be planted during October or the first week in November on this farm. A three-furrow drill is used at all times. Wheat yields run from 40 to 50 bushels. Barley is sometimes grown after wheat on the vale land, when it has become "bean sick." On this heavy land there is a tendency to put in beans too often, and the growing of barley gives two white straw crops, which is a better preparation for the clover crop. The clover mixture for the vale land is 6 lb. cow grass clover, 6 lb. English broad red clover, and 6 lb. alsike per acre. For the hill land the following is used :— 6 lb. cow grass clover, 6 lb. English broad red clover, 4 lb. alsike clover, 4 lb. white clover, and 1 bushel Italian rye-grass per acre.

Roots are grown on the hill land. Mangold are manured with 20 tons per acre of farmyard dung and 10 cwt. of mangold manure; a top-dressing of 1 cwt. of sulphate of ammonia and 1 cwt. nitrate of soda per acre is given in two

dressings. The mangold seed is drilled in rows 18 in. apart on the flat, and the plants set out 12 in. apart. Turnips receive 15 tons per acre farmyard manure and 5 cwt. turnip manure. Barley and oats follow roots on the hill land. The barley is not specially manured. The oat crop receives 5 cwt. per acre of superphosphate. An average yield of oats is 70 bushels per acre. The soil on the hill having shown a tendency to become clover sick, a mixture of 15 lb. sainfoin seed and 10 lb. lucerne has been sown instead of "seeds." This will be mown for sheep fodder.

This year, for the first time, Mr. Dudfield grew potatoes to give his soil a change from turnips. "Up-to-date" was the variety selected. In addition to the farmyard manure, the potato crop received 1 ton of soot and 5 cwt. of special manure per acre, and there was every prospect of an excellent crop.

The areas under various crops this year included wheat, 34 acres; beans, 11 acres; oats, 10 acres; mangold, 4 acres; potatoes, 6 acres.

The grass land is well grazed by cake-fed heifers from May Day until November, and also by the sheep. Basic slag, at the rate of 7 cwt. per acre, is applied from time to time, with success. In dry weather this land cracks very much, and opens 2 to 3 ft. deep down to the drains. Sixty acres were sown down to permanent grass within the last five years, the following mixture being used at a cost of 28*s*. 6*d*. per acre, with every appearance of success:—

4	lb.	Pacey's perennial rye-grass
2	„	Cocksfoot
3	„	Timothy
2	„	Foxtail
4	„	Meadow fescue
1	„	Fine-leaved fescue
3	„	Hard fescue
2	„	Sheep's fescue
1	„	Various-leaved fescue
1	„	Rough-stalked meadow grass
1	„	Smooth-stalked meadow grass
1	„	Wood meadow grass
1	„	Fiorin
2	„	Dogstail
½	„	Sweet vernal
3½	„	Cow grass clover
3	„	White Dutch
1	„	Alsike
1	„	Trefoil
37		

The quantities of cocksfoot and foxtail were kept low in the mixture, as these grasses are indigenous to the soil; tall fescue was not included because of its liability to ergot and consequent danger to stock.

Horses.—Mr. Dudfield is a breeder of Shire horses, and acts as secretary to the local Shire Horse Society. Six or eight mares are put to the horse each year, and the geldings sold at five years old. There are twenty horses and colts about the farm, and they are an exceptionally good lot.

Cattle.—These consist of purchased heifers of a very good class, about 200 being run round the farm in the course of a year. Good, strong cross-breds, from two to three years old, are purchased, and finished off with cake, which will vary in quantity from 3 to 6 lb. per head. The cakes used are cotton, linseed, and Bibby's compound, and the length of time the heifers remain on the farm depends entirely upon the supply of grass and the state of the trade. As a rule, 100 heifers are bought in the autumn and 100 in the spring or summer. The cattle were very good butchers' beasts, both for weight and quality. Any heifers that turn out in-calf, that are of good size and show promise of being good milkers are sold in the spring; the rest are calved, and the calves fed and sold to the butcher, and the heifers grazed for early beef in the following year.

Sheep.—The system here is to keep 170 breeding ewes and sell the lambs as stores early in August. The ewes were originally Romney Marsh and crossed with the Hampshire ram, but Mr. Dudfield is now working back to the Oxford-Hampshire cross. A few of the best ewe lambs are retained for the flock, but most are sold early in August to make room for the heifers. The ewes and lambs are given mangold and Townsend's sheep food.

Pigs.—One Black boar and five sows of the Large White Breed are kept for breeding purposes, and the young pigs sold off as soon as they will make 20*s.* each, except a few, which are fed up for bacon for the house and cottages.

One hundred and fifty head of poultry are kept to pick up loose corn and otherwise earn their living.

The landlord supplies drain pipes, posts and rails, timber for gates, and stone for roads. The tenant lays the drains, erects fences, makes the gates, and hauls the road material.

Mr. Dudfield's gates were very good, and his system of double gates for windy and exposed positions is quite ingenious. The double gate is most useful where a bridle-road goes through a corn-field with a pasture-field adjoining.

Labour in this district runs from 13*s.* to 15*s.* per week, with cottage and extras. Mr. Dudfield's labour bill is about 350*l.* per annum. Fifty tons of cake and meal are purchased annually for the cattle, sheep, &c.

The Judges were given to understand that this farm was in a very bad state when entered upon by Mr. Dudfield thirty

years ago. However that might be, there is no question as to its excellent condition now. The tenant admits that the farm is well adapted for a dairy farm, but not having experience in that line he started as a grazier and corn grower, and by dint of hard work and good management has succeeded.

The farm looks well and full of condition. The pastures have a good face on them which is not natural to the land, but only possible with good feeding. Land clean; crops good; fences and implements well looked after; general management good; were the conditions the Judges found.

Class IV.—First Prize Farm.

Occupied by Mr. William P. Hill, Moorend Estate Farm, Slimbridge, Gloucestershire.

This farm is held on a yearly tenancy under Lord Fitzhardinge, and has been occupied by Mr. Hill for seventeen years. It consists of 145 acres of pasture land (including 6 acres of orchard) and 36 acres arable land. The tenant is not bound down to any particular form of cropping. The arable soil is light with a gravel subsoil, but some of the pasture is on heavy land. A three-course system of cropping is adopted—

Roots   Beans

Wheat

Oats   Barley

Beans   Roots

Wheat.

Twelve acres of wheat are grown each year, followed by 6 acres of winter oats and 6 acres of barley. Beans follow the oats, and roots, chiefly mangold, follow the barley, then back to wheat again on the bean and root land. Wheat and barley average 40 bushels per acre.

Manuring.—Beans are dressed with 10 tons per acre of farmyard manure, and the crop averages about 36 bushels per acre. Roots receive per acre 20 tons of farmyard manure and 5 cwt. of a local fertiliser. The root crop consists mainly of mangold, only 1 acre of swedes being grown. The oat crop is usually top-dressed with 4 cwt. per acre of a local fertiliser, the average yield being 60 bushels per acre. The pasture land receives no special treatment, being well grazed by the dairy

cattle. The mowing grass is dressed with 8 tons per acre of farmyard manure every fifth year, and on the heavy land basic slag at 6 cwt. per acre is applied in January every fifth year.

Horses.—Four cart horses and two nags (one of the latter for the milk trade) are kept. The cart horses are of the Shire type, bought in at three years old and sold at five or six years old. This "dealing" in horses explains the keeping of more horses than are really required for the land, and the desire not to overwork them meanwhile. The horse ration consists of hay, straw, chaff, and crushed oats.

Cattle.—A very useful lot of forty Shorthorn dairy cows are kept. The milk is sent to London and averages 7*d.* per gallon, except a surplus in May and June which is made into Single Gloucester or Cheddar Loaf cheese. About sixteen calves are weaned yearly, the steers being sold at one and a half to two years old and the heifers brought into the dairy herd at two and a half to three years old. Weaned calves are given linseed cake up to 1 lb. per head per day until one year old. The heifers are usually put to the bull at from one year and eight months to two years and three months old so as to have some coming into the dairy herd in the autumn and in spring and early summer.

During the summer months when lying out at grass the dairy cows get no artificial food, but after Michaelmas the newly calved and best milking ones receive per head 2 lb. of soya bean cake and 2 lb. of cotton cake daily. During the winter months the ration per cow per day is 45 lb. pulped mangold, 16 lb. hay and straw chaff (equal parts), and 5 lb. crushed oats or maize, served at 7.30 a.m. and 5.30 p.m. At midday 4 lb. per head cotton cake, and hay at 12.30 p.m., and a little more at 8 p.m.

From Lady Day to Michaelmas milking takes place at 5.30 a.m. and 4.30 p.m.; during the winter half-year at 6 a.m. and 4 p.m. The cows were a good sort, kept in good condition, and looked like yielding a lot of milk.

Sheep.—Twenty Radnor ewes are bought each year in August or September and put with a Hampshire Down ram. Usually thirty lambs are reared. The sheep are on the grass land only, and as they have a big run, both lambs and ewes usually get fat without any artificial feed. Mr. Hill does not believe in keeping many sheep, his experience being that they rob the dairy cows and spoil the hay crop.

Pigs.—No sows are kept. A few pigs are bought in from time to time and fed on maize and barley meal for bacon.

Orchard.—The best fruit is picked and sold, and the small made into cider for home use chiefly, but occasionally some is sold at from 10*d.* to 1*s.* per gallon.

The buildings are good and suitable, and are kept in very tidy condition. No cottages go with the farm.

The landlord allows timber for fencing, good oak gates at 2*s.* 6*d.* each, and the cost of metal for roads.

Labour here runs from 15*s.* to 16*s.* per week with allowance of cider. Mr. Hill is efficiently assisted in the conduct of the farm by his sons, so that his outgoings in labour only amount to 150*l.* per annum. Purchased foods cost 97*l.* per annum. Hoeing and singling mangold costs 14*s.* per acre (twice over); hoeing corn, 4*s.* to 5*s.* per acre ; hedging, 9*d.* per perch.

This farm was characterised by good and economical management, clean land, good crops, and rent-paying stock.

CLASS V.—FIRST PRIZE FARM.

Occupied by Mr. Francis Hawkins, Sugwas Farm, near Hereford.

This farm is held under a lease from His Honour Judge Ingham, and has been farmed by Mr. Francis Hawkins for thirty-five years, having been occupied by Mr. Hawkins' father for the previous sixteen years. It consists of 263 acres arable, 209 grass, and 68 acres of pasture orchards. The soil is a light free-working loam on a gravelly subsoil which, in some places, runs into large stones and has a tendency to burn. The lease does not bind the tenant to any prescribed form of cropping, and on this farm we have the wisdom of the "open" agreement clearly demonstrated by good crops on clean, well-cultivated land full of condition. The rotation of cropping followed is the ordinary four-course of roots, barley or oats, clover, wheat, with any slight variation rendered necessary by season or other circumstance. The areas under various crops this year were wheat, 66 acres ; barley, 42 acres ; oats, 34 acres ; peas, 10 acres ; clover, 50 acres ; roots, 58 acres ; potatoes, 3 acres. Peas are grown when clover fails. Rape is sometimes sown if another crop has missed. If it is considered necessary or desirable, a second white crop may be taken after wheat, in which case the wheat stubble is ploughed in the autumn and cultivated in the spring for oats, or ploughed twice for barley. A few vetches are grown for the horses, and this land is afterwards planted with roots. The root crop consists mainly of swedes, and receives practically the whole of the applied manure for the rotation. Swedes are manured with 10 tons per acre farmyard manure, 4 cwt. ground bones, 4 cwt. kainit, and ½ cwt. of nitrate of soda. The raw bones are ground at home, and if a little slow in their beneficial action for the swedes, they leave something for the succeeding crops. The seed is drilled in rows

22½ in. apart and the plants singled out at 10 in. apart, unless late in the season, when they are left 9 in. apart. Mangolds are grown to the extent of about 12 acres, and receive 12 tons per acre of farmyard manure, 2 cwt. of salt, 4 cwt. kainit, 5 cwt. ground bones, and 1 cwt. nitrate of soda. During the autumn the kainit is applied to the ground which is coming for mangold, the bones and ½ cwt. nitrate of soda at time of sowing the seed, and a top-dressing of salt with, say, ½ cwt. nitrate of soda mixed with a little ground bones so as to sow better, is given after "singling." The mangold seed is drilled in rows 24 in. apart, and the plants "singled" at from 9 to 10 in. apart in the rows. Barley or oats follow the roots, about half of which have been consumed on the land, and these crops are not especially manured, but frequent change of seed is found to be beneficial. The clover seeds mixtures sown under the barley and oat crops are as follows:—

lb. per acre	For mowing	lb. per acre	For grazing
14	Cow grass clover	2	Cow grass clover
2	White clover	12	White clover
4	Timothy grass	3	Timothy grass
4	Perennial rye-grass	3	Perennial rye-grass
—		—	
24		20	

The clovers are down for one year only. Wheat follows and is not especially manured as a rule, but occasionally kainit, or salt, or lime has been applied. A frequent change of seed is practised.

The wheat crop is usually "flagged." This is done by men walking through the crop and cutting off the top "flags" with reaping-hooks a few days before the wheat bursts into "ear." Occasionally strong crops of oats and barley are "flagged." The cost is about 2*s.* 6*d.* per acre, and the benefit derived much depends upon the weather, as the object of flagging is to prevent a crop being "laid." Therefore one does not flag a light crop. The following yields per acre represent the average of several years, including a bad season:—Wheat and barley, 5 quarters; oats, 10 quarters; clover hay, 2 tons; mangold, 37 tons; swedes, 25 tons. A very dry season is a serious matter on this farm.

Of the 209 acres of grass land about 60 acres are mown each year.

All the liquid manure from the yards is pumped on to one of the mowing meadows by means of a rotary pump, driven with the same power and at the same time as the other barn machinery.

The rest of the land mown is manured with compost and by sheep eating roots with cake and corn during the spring, also occasionally with home-ground bone dust.

The pasture land looked very nice indeed, having an excellent "face" on it. The pastures in years gone by have been liberally treated with ground bones, thus laying a foundation for good grass, which is now well grazed by stock receiving both cake and corn and requires no further treatment to keep it in good condition.

The orchards were very old, and the fruit probably only fit for cider, but there is a very promising young standard orchard of 4 acres planted with the best kinds of fruit trees.

The **Horses** consisted of eleven working horses, three mares with foal, five colts rising four years old, two colts rising three years old, five colts rising two years old, six colts rising one year old, two riding horses, and two ponies. Some of the horses are bought and some are bred. The explanation of the large number is that sales are constantly taking place as soon as the horses are fit for town work, that the brood mares are not available for farm work for a considerable portion of their time, and that the young horses are not allowed to do too much work. The horses are of the Shire type, good and useful for their work, of good stamp, have plenty of bone and body with good feet and hair, but were rather poor in condition at the time of our first visit from continuous hard work. The horses work nine hours per day during the summer and eight during the winter, with a break at mid-day. During the summer the daily allowance for each horse is 6 lb. of a mixture of oats, beans, and maize, and they lie out at grass by night. In the winter months the "corn" is increased to 10 lb. per head, with long clover hay at night.

The **Cattle** are sixty-five store bullocks, twenty-three fattening heifers, eighteen store heifers for autumn calving, seven milking cows, and one bull. These are all bought in. They are principally Herefords, but Shorthorns are sometimes bought; for feeding purposes mostly heifers, but some bullocks for stores during winter. These are usually sold in the spring for grazing in the Midland counties. Mr. Hawkins generally has some Shorthorn cattle to calve about early autumn to sell out for milkers. The ration for fattening cattle during the winter consists of cut straw and hay with roots, and from 6 to 8 lb. of cake and corn mixed, with long hay at nights. Stores get cut straw and hay with a few roots, the bullocks and best cattle for feeding having from 2 to 4 lb. cake per day. During summer the feeding cattle have from 4 to 6 lb. corn and cake per day out on the grass. The stores during summer have the grass only. The number of cattle on

the farm varies from 60 or 80 during the summer months, according to the quantity of grass, to 140, including stores, during the winter—being bought in or sold out according to circumstances and market value. The cattle seen were good and suitable for their respective purposes.

Sheep.—The flock consisted of 252 breeding ewes, 130 yearling ewes, 198 wethers feeding on roots, 3 rams, and later 362 lambs, all of the Shropshire breed. About 250 ewes are put to the ram. The lambs are kept on cut roots during the winter with about $\frac{1}{4}$ lb. "corn" per day for wethers and feeding sheep, and half the corn for young ewes. When the feeding (fattening) sheep come off the roots they have mangolds on the pastures until the clovers are ready, with about $\frac{3}{4}$ lb. cake and corn per head, and are sold off during May and June. The cake and corn mixture for sheep consists of linseed cake, cotton cake, crushed oats, and peas. The ewes in "yean" have hay and a few roots on the pasture during winter. All draft ewes are sold out in August for stock purposes. The best of the ewe lambs are retained for the flock, the remainder being fattened off with the wether sheep.

Pigs.—About half-a-dozen "store" pigs of the White Breed and two "baconers" are bought, to act as scavengers and supply the household.

Manures and Feeding Stuffs.—The system of manuring here adopted is practically to manure once only during the course of the rotation, viz.: for the root crops, excepting where necessary to "start" or "touch up" a crop. The roots receive all the farmyard manure, which is spread out thinly over a large area and supplemented with ground bones and other fertilisers. Ground bones enter very largely into Mr. Hawkins' scheme of manuring, and are applied at from 4 to 7 cwt. per acre. The grinding of the bones is all done at the farm by a Harrison & Carter disintegrator. The bones are bought at about 4*l.* per ton, ground down to "meal" and used raw.

Artificial manures purchased amount to 117*l.* per annum. Home-grown produce consumed at home is valued at 250*l.* Purchased foods amount to 360*l.* for linseed cake and cotton cake, and 254*l.* for corn. This totals to 981*l.* per annum, and works out at 36*s.* 4*d.* per acre, not including manures made at home.

Buildings and Implements.—The farm is supplied with ample buildings, which consist of two large yards facing south with deep shelter sheds and gangways, forming a lean-to to the main range of feeding houses, machinery houses, granaries, three large Dutch barns, &c., and is replete with modern implements and machinery, all well looked after. A

noticeable feature is the care and tidiness shown all round—the accumulated manure in the yards thrown up into neat heaps with a layer of earth over the top of each; the liquid manure from the yards driven to the meadows by means of a rotary pump and piping; complete sets of machinery for steam cultivating, threshing, bone-crushing, grinding, pulping, &c., and good implements. A suction gas plant is the power used for driving the barn machinery. Bone-grinding, threshing, and cultivating machinery is driven by a Marshall steam portable engine.

The tenant is responsible for the upkeep of the buildings, ordinary wear and tear excepted, being allowed material and timber in the rough. He is also responsible in the same way for the drainage, fences, gates, and four cottages, but is not responsible for the farm roads. The farm is provided with four cottages, in addition to which Mr. Hawkins has erected four others on land owned by himself.

Book-keeping.—A complete set of well-kept books was shown to the Judges. Mr. Hawkins was thus able, and willing, to answer any question concerning the finances of his farm, and to indicate exactly the amount of profit arising from any branch of his farming.

Costs.—The labourers consist of seventeen men and two boys, a certain amount of work being done by contract. An average wage is 14*s*. per week with allowance of 2 to 3 quarts of cider per day; also 25*s*. extra for harvest with some food, and 400 yards of potato ground worth about 10*s*. Carters have 17*s*. to 18*s*. per week with similar perquisites, and occupy cottages on the farm, for which they pay 2*s*. per week rent. The total cost of labour runs about 750*l*. per annum, or 28*s*. per acre, and the result shown is a credit to the management. Piece work prices paid comprise: hoeing roots (twice over), 10*s*. per acre; pulling and cleaning roots, 10*s*. to 11*s*. per acre; common turnips, 1*s*. per acre less; reaping by hand, 12*s*. to 18*s*. per acre; laying hedges, 3*s*. 6*d*. to 5*s*. 6*d*. per chain of 22 yards.

Everything on this farm was well done—good management and personal care being shown in each detail. Stock generally good; crops all good; land well cultivated, very clean, and in good heart; pastures very well grazed and looking in good order; hedges and ditches neatly kept and well cleaned; machinery and implements up to modern standards and well kept; buildings and yards neat and tidy; well kept accounts; and finally, a good return shown on a large capital outlay.

Class 5 was a strong, well-contested class, and it required a good man to win, but Mr. Hawkins' farm looked like winning right through and succeeded on its undoubted all round merits.

Mr. Hawkins had the pleasure of winning First Prize in the "Royal" Competition in 1884, so that his present success is all the more remarkable and gratifying, he having accomplished what few can hope to do—having secured two First Prize "Royal" Farm Competition successes—and having maintained his position throughout a period of twenty-five years.

Class VI.—First Prize Farm.

Occupied by Mr. George Brooke, Severn Stoke.

This farm comprises about 135 acres, made up of 64 acres arable, 56 grass, 7 pasture orchards, and 4 acres fruit, with house, buildings, &c.

It is held on a yearly tenancy, under the Earl of Coventry, and has been in Mr. Brooke's occupation for fourteen years. He has, however, lived on it nearly all his life, having been with an uncle who farmed the land from 1836 to 1895.

The fields lie nicely together, with the exception of 25 acres of meadow land by the Severn, nearly a mile away. The soil is light loam with gravel subsoil. The tenant is not bound by agreement to any form of cropping, and generally works on the following rotation:—

Wheat

Mangold, or Peas, followed by

Kale or Turnips

Oats

Barley

"Seeds"

Wheat.

Latterly very little wheat has been sown, oats having been grown instead. Oats have also, to a slight extent, replaced the barley, thus becoming the principal crop. It is, however, intended to return to the original system, now that wheat and barley make a better price. Crops this year comprise: wheat, 3 acres; oats, 23 acres; barley, 8 acres; peas, 10 acres; seeds, 9 acres; mangold, 10 acres.

Root Crop.—Mangolds form the principal root crop, the land being subject to "Finger-and-Toe" in turnips. The land

is worked as soon after harvest as practicable, and receives a dressing of 12 tons per acre of farmyard manure in the spring. Webb's Lion Intermediate is the variety most favoured here. After the mangold crop is "singled," a top-dressing of 1 cwt. per acre of nitrate of soda is applied. The "hoeing" and "singling" of mangold is done by day work. Mr. Brooke likes the mangold left pretty thick on the ground. They are "cut out" with a 6-inch hoe and very carefully "singled"—hence the preference for day work. The mangold crop is mainly used for feeding cattle, but should there be a surplus it is carted into heaps on the arable land, so that the land may be dressed by sheep consuming these roots.

Peas.—The land for this crop is worked after harvest and dressed with farmyard manure, at the rate of 12 tons per acre, during the autumn if possible. Harrison's Early Eclipse peas are planted, as soon as it is possible to do it, well in January.

As soon as the peas are up the horse-hoe is kept going to keep them free from weeds, and a last hoeing is given by hand close to the rows. When just beginning to blossom the peas are "laid" or "moulded." That is to say, the peas are laid over to the south and mould put on to keep them so laid. They are sown to be picked green in June. The crop is sold by auction as it stands, and an average crop will realise 12*l.* per acre, leaving the haulm, which is made into hay. The picking is done by the purchasers' men at 6*d.* per pot.

The Judges were much impressed with the good crop of peas which were just going to be sold by auction at the time of the second visit. They are sold at the field and generally bought by Birmingham customers. The first thing the purchaser does is to employ men to look after birds and go over the field "topping" the peas, that is, beating the tops of the peas with sticks so that the crop shall come uniformly together, and thus have no late pods.

Turnips.—This crop sometimes follows peas in the same year, but difficulty has been experienced owing to "Finger-and-Toe." The pea crop ground is ploughed and drilled with turnips during the first week in August. The Green Globe variety is grown. Swedes are not grown.

This crop supplies the requirements of the cattle and sheep until, say January, when the mangold come in. This year after the peas had been removed ground lime was put on for the turnip crop. The intention was to apply 10 cwt. per acre with a distributor set to sow that amount. The quantity distributed, however, was only 8 cwt. per acre, so the field was crossed again to use up the lime. In this way 3 acres of the ground received 16 cwt. per acre, and the turnips were much better on this portion, and on the whole were the best

grown for many years, having very little "Finger-and-Toe," and that chiefly where the lighter dressing of lime was given. The intention is to lime again this year for the pea crop at the rate of 15 cwt. per acre, and if found beneficial to the peas and following turnip crop to lime each year as the land comes into peas, say once in four or five years. The ground lime used was obtained ready ground in bags from Willsbridge, near Bristol, at 17*s*. 3*d*. per ton delivered.

Kale.—When Thousand Head kale follows the pea crop it is drilled with a little hand drill between the rows of peas towards the end of May, after the peas have been "laid" and "moulded." When the peas have been picked the kale is cleaned by hoeing and then allowed to grow thick on the ground. It is ready for the sheep to feed on by the end of October. Owing to the trouble with "Finger-and-Toe" kale has proved a safer crop to take after peas than turnips.

Oats follow the mangold crop, and also follow the kale or turnip crop taken during the summer and autumn after peas, and are not especially manured. Garton's "Abundance" is the oat most grown here, and is sown as early as possible in January. The oats are not hoed, but harrowed and rolled, and yield an average of 10 quarters.

Chevalier barley follows oats. This crop receives a little artificial manure and yields 45 bushels per acre.

Clover seeds are undersown with the barley crop, and consists of 14 lb. broad red clover and 1½ pecks of Italian rye-grass per acre. These "seeds" are usually mown twice and "sheeped" afterwards. The crop sown was very good.

Most of the hay is consumed at home, very little being sold.

Webb's Standard Red wheat follows the clover and is not specially manured. An average yield of wheat is 40 bushels per acre.

The pastures are of rather poor quality, but are being well grazed with cake-fed cattle and sheep. The Severn meadows have suffered in past years through being mown too much and are now much improved by recent dressings of 7 cwt. per acre of basic slag and the grazing of cake-fed cattle. The home pastures are well grazed and in addition receive a little farm-yard manure when there is any to spare. Mangolds are consumed on the home pastures by cake-fed sheep in the spring.

Horses.—These comprised four working horses and two colts. The custom has been to breed colts to take the place of the old horses, but Mr. Brooke is selling out his brood mares and intends to buy in future. The horses do not lie out at night. Their ration consists of a mixture of bean meal, oats, and bran.

Cattle.—All cattle are bought in and sold off fat. The custom is to buy strong well-grown beasts and feed them up in the yards during the winter and on the pastures in summer. When in the yards the cattle are given mangold, straw, decorticated cotton cake and bean meal in equal parts, and sometimes oat meal as well. The quantity of cake and corn varies according to the size and age of the cattle. A strong well-grown bullock would start at 6 lb. per day and finish at 12 lb. When caking cattle on the grass, up to 8 lb. per head of decorticated cotton cake is given. Both bullocks and heifers are bought, of whatever breed—Hereford, Shorthorn, or "Cross"—that comes handy. Between thirty and forty beasts pass through the farm in the course of a year. One milking cow is kept to supply the household.

Sheep.—All the sheep are bought. Mr. Brooke feeds out nearly three hundred in the course of a year, and as he could not breed many on his holding he prefers to buy all. The sheep are purchased to feed on the kale or turnips grown after peas, and to finish on mangolds. They receive a mixture of equal quantities of cotton cake, linseed cake, and old beans, with chopped pea-straw. The quantity of corn given varies from ½ lb. to 1½ lb. per head per day according to circumstances. Oats are sometimes given instead of beans.

Pigs.—Five sows are kept for breeding purposes, and the young pigs sold off when worth from 20*s*. to 25*s*. each.

Labour here runs at 15*s*. per week without a cottage, but with allowance of two quarts of cider per day from May to Michaelmas. More cider is allowed when working hay or harvest. The shepherd's wages are 17*s*. per week, out of which he pays 1*s*. 9*d*. per week rent for a good cottage and garden. He receives also 1*s*. 6*d*. per rick for thatching, 10*s*. for dipping sheep, and 1*s*. for each journey to market. The carter has 17*s*. per week, and pays 2*s*. rent. The men are allowed to have pigs from the farm, which they pay for on the instalment system. During the summer months the men are given the opportunity to work until 8 o'clock at night, allowing half-hour for tea at 5.30 to 6 p.m. The men receive an extra 6*d*. per day for this.

Mr. Brooke's labour costs 33*s*. 3*d*. per acre. Artificial manures come to 3*s*. per acre, and notwithstanding the considerable consumption of home-grown produce, purchased foods cost 2*l*. per acre.

Orchard.—Mr. Brooke has planted 11 acres of fruit trees, consisting of 4 acres plums (with gooseberry bushes in between), and 7 acres of apples. The landlord supplied the trees, the tenant doing all the labour, planting, pruning, and protecting. Four acres of pasture orchard, planted in 1899,

comprise ninety-six culinary and sixty-nine dessert trees; 3 acres of old orchard pasture have been filled up with thirty-six trees of culinary and fifty-six trees of cider apples. The plum orchard contains:—

Early	Rivers Prolifics.
2nd Early . . .	Egg or Pershore Plum.
3rd Early . . .	Victorias.
Late	Ponds Seedlings.

The orcharding is well done and looked after; trees properly protected from the grazing stock, well pruned, and cared for. The plum trees and gooseberry bushes were all good and looked like being productive. Mr. Brooke endeavours to sell the bulk of his gooseberries "green." Green gooseberries pay, but ripe ones "draw" the bushes and meet with no demand in the market.

Years ago this farm comprised a lot of small fields, and probably two miles of old fences have been grubbed up, as also two or three pieces of "cover" which the landlord was good enough to do away with. Mr. Brooke's farm was a good first, and well worth a visit from any one interested in agriculture. The cultivations were very good, the land clean, and the crops excellent. The pastures are of rather poor quality, but well grazed. Orchards good; hedges good; stock "fair"; horses "moderate."

Class VII.—First Prize Farm.

Occupied by Mr. H. T. Nott, Kyrewood, Tenbury.

This farm is held under yearly tenancy from E. Vincent V. Wheeler, Esq., and has been occupied by Mr. Nott for seven years. It consists of 86 acres arable, 151 acres grass, 49 acres hops, and 6 acres of ash plants. There are 74 acres of fruit included in the grass and tillage acreage. The plough land generally is good, varying in character from a sandy loam to a medium clay. While being "free-working," on the whole, there are veins of stiff clay in nearly every field. The tenant is not bound down to any particular form of cropping. The plough land is worked on a five-course system, as below:—

Roots
|
Oats
|
Seeds
|
Wheat
|
Oats, Barley, or Beans

the fifth crop of the rotation being determined by the nature of the field. Vetches are sown during autumn on the ground which is coming in for roots. They are cut "green" for the horses, and followed by roots. After an early harvest mustard is sown on the stubbles whenever possible.

The acreage under various crops this year was: wheat, 23 acres; barley, 13 acres; oats, 19 acres; vetches, 3 acres; mangold, 5 acres; roots, 12 acres; potatoes, 2 acres; seeds, 10 acres.

For roots each year the land is subsoiled to a depth of from 11 to 13 in. An ordinary digging-plough takes the first 8 in., and a swing-plough with the mould-board removed stirs another 4 or 5 in. in depth under the furrow made by the digging-plough. This has been found to be an excellent means of getting rid of thistles, and while moving the ground deeply does not bring any raw soil to the surface.

All land intended for roots receives from 18 to 20 tons per acre of raw farmyard manure; that is, manure drawn straight from the cattle-sheds. Mangolds, at time of planting, receive from 6 to 8 cwt. per acre of artificial manure, a usual dressing being 2 cwt. kainit, 2 cwt. superphosphate, and 4 cwt. dissolved bones. The mangolds are planted on ridges 22 in. apart, and are left thickly in the rows when the singling is done. It is considered that mangold will do well much closer together than swedes, and left in this closer order they produce a much better crop than when left wide apart to grow excessively large. After hoeing, the mangold are top-dressed with 3 cwt. of salt and 1 cwt. nitrate of soda per acre, and this dressing is repeated about a month later. The salt has a most marked effect and pays well for its use. This year the mangold crop averaged almost 50 tons per acre. Yellow Globe forms the main crop, but a few Golden Tankards are always grown for the sheep.

In the case of swedes, superphosphate is mainly relied upon to help produce a good crop, supplemented by small quantities of kainit and dissolved bones. The "Superlative" variety does excellently on this land, both as regards quantity and quality. The land varies very much, every field having two distinct types of soil. Owing to the configuration of the tillage fields, heavy rains and thunderstorms prove very disastrous, washing away the soil. Three times in six years of the present tenancy the swede crop has been badly washed and the fields damaged.

Oats follow the roots and are not especially manured. Seeds are undersown with the oat crop, for mowing one year—16 lb. red cow grass clover and 3 lb. Italian rye-grass per acre. The clovers are always mown twice, the second

cut being harvested for seed when the clover is well "headed." The rye-grass seed is readily separated from the clover by means of the screens in the winnowing machines. The first cut is usually taken about the third week in June. If the second crop is well headed it is left to become perfectly ripe and cut for seed, otherwise it is used for a fodder crop and is found to be very good feed for fattening sheep.

Wheat follows the clover, and is in its turn followed either by oats, barley, or beans, according to the character of the soil. Wheat averages 45 to 50 bushels per acre and oats about 70 bushels.

There are 46 acres of mowing grass, which are treated each year with a dressing either of: (*a*) 2 cwt. fish guano and 2 cwt. superphosphate, or (*b*) 3 cwt. superphosphate, 2 cwt. kainit, and $\frac{3}{4}$ cwt. sulphate of ammonia or nitrate of soda per acre. The fish guano is found to be very effective. The pastures are well grazed. Basic slag has been tried on several of the fields, but in one instance only has it shown any marked effect.

The hops are all grown on a deep loam soil by the side of the river Teme. One hop-yard of 26 acres is grown upon wire-work, the remaining 23 acres upon poles. Most of the hops are "Mathons," for which variety the soil appears to be very suitable. A few "Bramlings" and "Fuggles" are grown for early and late picking respectively. The "Fuggles" crop heavily but the "Bramlings" do not stock well. The hops are planted in rows, 9 ft. apart, a distance of 3 ft. 3 in. to 3 ft. 8 in. being allowed from stock to stock, which means about 1,300 stocks to the acre.

In the wire-work yard, three strings fixed V-shaped are allowed to each stock, two "bines" being trained up each string. In the pole-work yard, where two poles 13 ft. to 14 ft. long are placed to each stock, two hop wires to one pole and three to the other are usually found most satisfactory in giving the required amount of bine. As far as possible, all the manual work required is done by piece-work, calculated at so much per 1,000 stocks. Following the custom adopted throughout the Midland plantations, practically all the soil cultivation is done by horse labour, differing in this respect from much of the Kent work.

As soon as practicable, after the hops have been picked, the ground between the hop rows is ploughed up to the stocks to get all possible benefit from the winter frosts, and the reans being deeply moulded leaves the stock well drained. Ploughing down commences in the first favourable weather after the middle of February, the whole of the earth being

removed from the stock with the exception of about ten inches. The remaining soil is stocked away and the plants cut down to the crown by hand during March, this operation being completed by March 25 if possible. When sufficiently advanced, the coarse hop bines are pulled out and the most promising selected, two being trained up each string by merely twisting them round the string, and on the pole-work by tying with raffia grass to the poles. Once the hop bines can be started up the poles or strings, deep scuffling of the soil is commenced and continued as much as possible throughout the season. One or two furrows are ploughed up to the stocks as soon as the tying is completed and the stocks well cleaned out, the remainder cultivated and finally ploughed up to the stock after the hops are picked. Fold-yard manure is used as far as possible. The other tillage land of the farm is not allowed to suffer, but as much of the best manure from the feeding cattle as can be spared is used on the hop-yards, and a considerable quantity of manure is bought from the neighbouring town of Tenbury. No fixed scheme of manuring is adopted, shoddy, raw and dissolved bones, Peruvian and fish guanos, and kainit in the autumn—or sulphate of potash in the spring—all being purchased, the condition of the markets and the appearance of the plant being the determining factors in the matter.

The cost of the hop washing varies immensely. In some seasons it is possible to do without it altogether, in others the vines must be washed at least twice a week to keep them in a clean state. Having every convenience for boiling, the old remedy of soft soap and quassia chips is here adhered to. About 8 or 9 lb. of soap and 6 to 8 lb. of quassia chips are used to each 100 gallons of water. When blight has been very severe it has been necessary to increase the soap to 10 or 11 lb. per 100 gallons of water and no evil effect to the foliage has been apparent. The wash is applied by a horse machine (three horses), about 220 gallons per 1,000 stocks of hops being used. Washing thus costs about 6*s*. per statute acre for materials and about 3*s*. for horse and manual labour in application, or 9*s*. per acre for each time of washing. Should a severe blight continue from the middle of June into August it will readily be seen that a very great expenditure is involved.

Mould is not very troublesome here, but if there are any indications of its appearance sulphuring is resorted to as early as possible after the blight is cleared away, about 20 lb. of flowers of sulphur per 1,000 stocks being used. A similar dressing is repeated if necessary. All sulphuring is finished before the formation of the cones if possible.

The estimated cost of hop growing at Kyrewood is as follows :—

Piece-work	Pole-work s. d.	Wire-work s. d.	Per 1,000 stocks Pole-work £ s. d.	Per 1,000 stocks Wire-work £ s. d.
Throwing down and cutting	4 0	4 0		
Spreading poles	1 0	—		
Pitching poles	8 6	—		
Tying and cleaning out stocks	7 0	7 0		
Stocking (when necessary)	3 0	3 0		
Branching twice, 2*s*. to 3*s*.	2 6	2 6		
Cutting vine and burning	1 0	1 6		
Stripping and piling poles	5 6	—		
Stringing, 1*s*. per string per 1,000	—	3 0		
Top stringing pole-work	1 6	—		
			1 14 0	1 1 0
Equals per statute acre			2 5 0	1 7 9

	Pole-work £ s. d.	Wire-work £ s. d.	Per statute acre Pole-work £ s. d.	Per statute acre Wire-work £ s. d.
Piece-work (as above)	2 5 0	1 7 9		
Labour exclusive of piece-work, estimated	3 7 6	3 2 6		
Making total labour			5 12 6	4 10 3

	Pole-work £ s. d.	Wire-work £ s. d.	Per statute acre Pole-work £ s. d.	Per statute acre Wire-work £ s. d.
Labour (as above)	5 12 6	4 10 3		
Manure	4 0 0	4 0 0		
Coir yarn, 3-string work	—	2 6 0		
Coir yarn, top of poles	0 5 0	—		
Raffia grass	0 2 0	—		
Hop poles, renewal 10 per cent.	2 10 0	—		
Horse labour	3 0 0	3 0 0		
Wear and tear of implements	0 15 0	0 15 0		
Depreciation in wire-work 5 per cent.	—	1 15 0		
[1]Rent and taxes	3 10 0	3 10 0		
Interest on capital invested in poles, wire-work, and implements	1 2 6	1 12 6		
Cost of growing, exclusive of washing and picking			20 17 0	21 8 9
Washing, say 8 times at 9*s*.			3 12 0	3 12 0
Sulphuring once, say 20 lbs. per acre			0 4 0	0 4 0
			24 13 0	25 4 9

From 300 to 350 full pickers are hired for the hop-picking season. They come from a manufacturing district by special train, their railway fares being paid for them, but when settling up at the close of the season part of the return fare is deducted. Many of the women return year after year, some

[1] Rent covers a portion of the expense of replanting with loss of one year's crop, spread over a period of twelve to fifteen years while the hops are in good bearing condition.

having come for twenty or thirty years. Bed clothing is given out on arrival and booked to each picker, and the same must be handed back at the close of the picking before a settlement is made. The cost of picking, curing, and putting on the market varies with each season, but 21*s*. 6*d*. to 30*s*. per cwt. will cover the usual variations.

From these figures it will be seen how extremely variable is the cost per cwt. of production. A full crop of 15 cwt. per acre grown in a suitable season without blight may not cost more than 21*l*. per acre, or 28*s*. per cwt., to grow; add to this 22*s*. per cwt. for picking and curing and 6*s*. 8*d*. for superintendence and you arrive at a total of 2*l*. 16*s*. 8*d*. per cwt. Whereas in a year of blight, a crop of 6 cwt. per acre may have cost 27*l*. per acre, or 90*s*. per cwt., to grow, picking and curing 28*s*., superintendence 16*s*. 8*d*., or 6*l*. 14*s*. 8*d*. per cwt., and as in many cases smaller crops are grown, the difference becomes still greater. A crop of 5 cwt. per acre may cost 108*s*. per cwt. to grow, 30*s*. for picking, curing, &c., 17*s*. 6*d*. for superintendence, or 7*l*. 15*s*. 6*d*. per cwt.

It may be of interest to note that out of the amount of 22*s*. to 30*s*. per cwt. calculated as the cost of picking and curing the hops, no less a portion than from 17*s*. to 23*s*. per cwt. is expended in wages, so that taking a crop of 10 cwt. per acre, the wages paid for harvesting the crop would amount to at least 9*l*. It has been shown that the manual labour involved in the cultivation amounts to about 5*l*. per acre, thus giving a total of 14*l*. per acre in wages. It would probably be within the mark to say that the average annual expenditure in wages on "mixed" farms in the Midlands does not exceed 30*s*. per acre.

Here we have a direct loss of 12*l*. 10*s*. per acre in wages when hop yards are converted into ordinary mixed grass and corn farms, as has been the case with several thousand acres during recent years. In Kent the loss is greater owing to the greater amount of manual labour per acre employed. This loss per acre over a large area, which is unfortunately increasing every year, is one which must appeal strongly to those interested either in the question of rural depopulation or in the health of the "submerged tenth" of the large towns near to the hop districts whence the ranks of the hop pickers are drawn. It affects both classes directly. To the rural labourer it means the loss of a job, and he migrates to the town for whatever he may find. To a great number of the poor of the urban population it entails the loss of a temporary sojourn in the health-giving atmosphere of the hop picking season and of the money with which to commence the dread task of facing the winter.

One appreciates the fact that competition is to a great extent the undoing of the English hop industry, and is constrained

to ask if nothing can be done to foster an industry of such national value. A considerable portion of "derelict" hop land is put under fruit, and it would be of interest to know what labour is involved in such cases. On the other hand, much of the hop land is low-lying near river sides which, owing to humidity and the danger of spring frosts, makes it not altogether suitable for fruit plantations.

Hops here were all dried on open fire kilns until this year, when three of the eleven kilns were fitted up with Joyce's patent hot-air plant. The result as far as sample is concerned is perfectly satisfactory and, with the addition of a fan, it is believed that this plant is capable of excellent results both as to quantity and quality of dried hops.

The orchards consist of 4 acres damsons, 13 acres plums, 57 acres apples. The principle adopted by the late owner was to plant up the poorest of the pasture land with fruit trees, so as to equalise the letting value of the whole farm. This has doubtless done so to some extent, but as a result some of the mixed apple orchards do not produce as abundant a crop as could be desired. About sixteen or eighteen years ago a large number of Ecklinville Seedling apple trees were planted, and many of the old trees cut back and grafted with this sort of apple. They, however, do not answer well in this district, and during the last three years the heads have been taken off these, and about 400 trees grafted with Bramley's Seedling, Worcester Pearmain, and Scotch Bridgets, and much better results are anticipated. Damsons do well, and the plums, chiefly Victorias and Pershores, bear well on the whole.

Horses.—These comprise eleven working horses, three two-year-old horses, and three nag horses. The working horses are of the Shire type, and were nearly all bred at home. Two years ago, however, the practice of breeding was given up, as the heavy work amongst the hops proved too much for in-foal mares. Young horses about ready for work are now brought in as required.

Cattle.—The conditions here are not suitable for cattle breeding, as there is a shortage of good open pasture or meadow land, and the orchards must be cleared of stock by middle of August. Thus the farm will carry only about thirty or forty cattle during the summer, whereas it can do with eighty to a hundred in the winter.

During the summer months about twenty Shorthorn heifers are kept for autumn calving, and fifteen to twenty heifers are fattened on a cake and corn ration working up to 8 lb. per head per day. During winter forty Hereford bullocks and thirty Shorthorn heifers are fed, and the twenty Shorthorn heifers

put to the bull, so as to come in as milkers in October and November, when they are sold.

The bullocks are purchased in the autumn, wintered in covered yards, with 4 lb. cotton cake, cut straw, and roots, and sold at the end of April; the fattening heifers receive from 4 to 10 lb. of mixed corn and cake per head per day.

Most of the cattle are thus changed twice in the course of the year, but no fixed rule is adopted, the decision being entirely governed by price and prospects.

Sheep.—Ninety Kerry Hill ewes, twenty-eight wethers, four Hampshire rams, and 116 lambs are kept. From 80 to 100 Kerry Hill ewes are bought each year and crossed with Hampshire ram lambs. Some of the produce are sold as fat lambs during May and June. The remainder have a small allowance of cotton cake after weaning. They go on to turnips in October, and finally are finished for sale on swedes from February onwards, having up to 1 lb. per head of mixed corn and cake. Ewes are bought in afresh each year and the old ones sold away in the autumn for breeding elsewhere.

Pigs.—Four sows of the Large White Breed are kept for breeding purposes. The young pigs are sold as stores or as porkers, according to the advantage to be gained from current market prices.

The whole of the hay and straw produced is consumed at home, and the farmyard manure thus made is supplemented by 150 to 200 tons of stable manure from Tenbury. In addition, artificial manures cost 260*l.*, and purchased foods 120*l.* to 180*l.* per annum.

Labour, exclusive of hop-picking, amounts to 600*l.* per annum. Cider is sold to the men at 4*d.* per gallon. No free drink is given.

The land was well cultivated, very clean, and carrying very good crops—a most perfectly managed farm as regards general husbandry and economy. Stock good and suitable; hedges kept in good order; orchards good; pastures well grazed; hops done well and system of washing good, water being laid on to the yards where the wash is mixed; accounts well kept and very satisfactory describe the management.

The Second Prize Farm in Class I.—held by Mr. Harry Butler, at Badminton, on yearly tenancy under the Duke of Beaufort—consists of 390 acres arable land and 337 acres of grass. It is situated at the south end of the Cotswolds, at an altitude of about 500 ft. The farm—both arable and pasture—is half on clay soils, and half on thin brash on an oolite subsoil which is very variable. Season has much to do with the routine of cropping. On the clay lands vetches, rape, and early turnips are grown to be fed off by sheep during the

summer. Wheat follows, and is sown at the end of September or the first week in October. The wheat is sown with the following seed mixture:—12 lb. cow grass clover, 6 lb. trefoil, 3 lb. alsike, 18 lb. perennial rye-grass, 10 lb. Italian rye-grass. The reason for this heavy seeding is that should the clay land carry a good sward and the brash land fail, the ley on the clay would be kept down for a second year.

Wheat comes after seeds and is followed by oats, which are dressed with superphosphate and sulphate of ammonia. Roots follow oats, and occasionally, according to season, roots again occupy the land for a second year, or instead of roots, green crops for summer sheep feed. The land for roots receives per acre, 12 tons farmyard manure, and 5 cwt. mineral superphosphate. If no farmyard manure, 5 cwt. bone manure used instead. Mangolds and cabbage receive a top-dressing of 2 cwt. of sulphate of ammonia applied at intervals.

On the brash land the roots are followed by barley or oats, seeded down as on the heavy land, except that 20 lb. of milled sainfoin seed is substituted for the Italian rye-grass. The seeds in their first year are mown once, the second year fed by sheep, then ploughed during July and August and planted with wheat in September or October. Barley follows wheat and is top-dressed with $1\frac{1}{2}$ cwt. of sulphate of ammonia per acre. The heavy land stubble is pared and burnt every autumn, which cleans the land and makes a good seed bed.

Catch Crops.—On the light land, if the harvest be early, mustard is sown on the stubble to feed with ewes, or trifolium for spring feeding, to be followed by vetches, the land coming into turnips afterwards.

Sainfoin is a valuable crop in this district, and from time to time a field is laid down with this crop. It is sown at the rate of 4 bushels per acre, mixed with the barley, and drilled at the same time, the drill going over the land twice at different angles. The sainfoin stands for six or seven years, sometimes longer. The mowing grass is manured with farmyard manure at the rate of 8 tons per acre, or with basic slag if farmyard manure be not available. The pasture land is well grazed by cake-fed stock.

The horses on the farm are Shires, and comprised nineteen working horses and five colts. They are a very useful lot. A milking herd of about forty-five shorthorns is kept, and the milk sold to the Anglo-Swiss condensed milk factory near at hand, at an average price for the year of $6\frac{3}{4}$*d.* per gallon of 10lb. The milk is delivered to the factory once a day. While out at grass during the summer months the cows receive 4lb. per head of Bombay cotton cake. The winter ration consists of 4lb. cotton cake, 4lb. dried grains, and 2lb. bean meal per day, with roots, chaff, and hay. A

feature of the farm is the herd of pedigree shorthorns, with which Mr. Butler has had considerable success.

The sheep consist of six Oxford Down rams, 291 Hampshire Down ewes, 394 lambs, and 116 ewe tegs, and are well managed. The system is to keep the sheep as much as possible on the arable land, and sell the young sheep out fat in the spring when twelve months old. Two boars and ten sows—all pure bred Berkshires—are kept for breeding purposes and the produce fed off. Poultry form a considerable item on this farm, this department receiving Mrs. Butler's special care and attention. The Judges were impressed by the thoroughness and attention to detail here shown, and the measure of success evidently attained. There are about 600 head of turkeys, ducks, and fowls. Pure breeds of fowls are kept for laying, and crosses with the Indian game for table birds. Artificial manures cost from 145*l.* to 150*l.*, and purchased foods from 1,200*l.* to 1,300*l.* per annum. The homestead and buildings on this farm are very good, and exceptionally well kept. The Judges considered the good management of stock and crop and the thoroughness shown in every detail fully entitled Mr. Butler to the Second Prize in Class I.

The farm occupied by Mr. James T. Hobbs, at Maisey Hampton, Fairford, consists of 624 acres arable and 471 acres grass. The basis of cropping is a four course—wheat, roots, barley or oats, seeds. A crop of rye on a small portion of the root land is taken, and about one-third of the root land is first cropped with vetches, then followed by roots. About one-fifteenth of the corn area is sown with winter beans after barley, and wheat follows the beans. The mangold crop receives per acre ten tons farmyard manure and four cwts. superphosphate. Swedes and turnips usually receive superphosphate only. The mowing grass is manured annually with eight tons per acre of farmyard manure. The pastures are well grazed with stock.

Twenty working horses are kept. The cattle consist of sixty-two cows, thirty-two in calf heifers, thirty-nine yearling heifers, twenty-four heifer calves, twenty bull calves, ten young bulls, and three stock bulls. The cows in full milk have a daily ration in winter of 6 lb. corn and 4 lb. mixed barley, oats and bean meal in equal parts, mixed with straw, chaff, and sliced roots or cabbage. In summer, when at grass, they have 4 lb. cotton cake per day. The heifers are kept in yards in winter, and have from 4 lb. to 6 lb. of corn according to age. The mixture given is equal parts of best linseed cake and cotton cake with the same amounts of barley, oats and bean meal—in each case mixed with cabbage or roots that may be in season; hay is given morning and evening.

For any animals set aside for show or sale purposes the amount of corn is increased. After turning-out time, which is usually about May 1, the heifers depend entirely on the grass. The young bulls coming on for sale are kept separately in open pens, and are allowed from 6 to 12 lb. of corn per day according to age. The mixture given is one half best linseed cake and one half oat and bean meal with a little bran, this is mixed with chopped hay and roots or cabbage. In summer, green fodder takes the place of hay.

The flock of Oxford Down sheep consisted of 299 stock ewes, 122 stock theaves, 95 shearling rams, 10 stock rams, 30 cull theaves, 64 cull ewes, 240 ram lambs and 247 ewe lambs. After the lambs are weaned at end of April, or beginning of May, the ewes are kept for the summer on the poorest of the grass-land, and clean up behind the lambs on the vetches and aftermaths. Kept like this, they should be in thriving condition to take the rams, which are turned out the first week in August. For the rest of the summer and autumn they clean up any grass and seeds, and in many cases, do not get any roots before Christmas. After lambing, they are allowed 1 lb. of corn per day until weaning-time; the mixture is one half cotton cake and one half crushed oats. They are given hay twice a day and folded on roots. The lambs, when strong enough, running forward, learn to take corn. After weaning, the ram lambs are separated from the ewe lambs, the former having per day 1 lb., the latter ½ lb. of concentrated food, viz.: a mixture of linseed cake, oats and beans. The lambs are usually weaned on to mixed seeds and get a few mangolds; after seeds, they go on to vetches, which is the main, and summer, food in this district. The ram lambs, wanted as shearlings for sale the following summer, go first to turnips in the autumn and then follow on to swedes, coming to rye and vetches with mangolds in the spring. Their corn is gradually raised to 2 lb. per day.

The basis of farming here is the production of high-class Shorthorn cattle and Oxford Down sheep, for both of which Mr. Hobbs is so deservedly well known. Strict economy in the use of feeding stuffs and the growth of as much corn as possible, to help pay for the purchased foods, are the objects kept in view. Labour runs to 1,800*l.* per annum; purchased foods to 1,270*l.*, and artificial manures to 70*l.*

Mr. Hobbs undoubtedly scores heavily with his stock. The cattle and sheep seen were a "show" in themselves, and their success in the showyards is his reward.

The farm occupied by Mr. Henry Matthews is very well managed. The cultivations, crops and stock were all good. There was however no feature of special interest to report.

The land occupied by Mr. John G. Rymer, at Apperley, Tewkesbury, consists of 60 acres arable, and 296 grass. The arable soil is a rather heavy red loam, good for wheat, beans and clover, and will grow heavy crops of mangold and cabbage. The greater part is top dressed with farmyard manure each year. The rotation of cropping is wheat, oats, beans, (or mangold and cabbage), wheat, oats, clover. The grass land is three-fourths meadow land subject to flood by the overflow of the river Severn, which keeps up the fertility. It is not impoverished by successive mowing, and is better mown than grazed. Consequently a large area of hay is cut each year and stacked on the river bank ready for transportation by boat to the midland towns. These meadows cannot be flooded regularly or at will, only when there is an unusual rainfall, which may take place twice in three years. Should a flood come early in the autumn or late in the spring, or at any time when there is a quantity of grass, a loss is—for the time being—sustained, the grass being spoilt. A flood generally runs off in about a week. The meadows are seldom stocked in the spring in order to allow a good head of grass before the dry weather comes in. The upland pastures are grazed. Shire horses are kept and bred, the colts broken in and sold at six years old. There is a dairy herd of twenty unregistered shorthorns. The system is to rear the calves and replenish the herd from the best heifers, and sell out the older cows with calf at foot. The steer calves are retained and fed out at about two-and-a-half years old. Being some distance from a station the milk is used for butter making, for which there is a good local demand. Mr. Rymer does not keep a standing flock of sheep owing to the liability to flooding. The arable land is too heavy for sheep folding, and such sheep as are required for grazing are purchased from time to time. Two large black breeding sows are kept and the progeny fed for bacon. About 500*l.* annually is spent on purchased foods, in addition to the consumption of a considerable amount of home grown produce. Labour amounts to 16s. per acre.

This farm is well and economically managed, and shows evidence of great personal attention to detail. The land is well cultivated, clean, and carrying good crops. The horses and stock are good and well looked after.

The competition in this class was good, and Mr. Rymer well earned the Second Prize.

The Dilden and Housemoor Farms, occupied by Messrs. C. Pendock & Son, comprise 83 acres arable and 100 acres grass, which is chiefly old pasture. The soils are red soil and heavy loam, the loam on clay subsoil—good quality soils, capable of producing good crops, very wet and cold in the winter and quite unsuitable for sheep.

The rotation course of roots, wheat, clover (down for two years), wheat or oats, catch crops or roots is generally followed. Beans and barley are omitted, not being profitably grown here. Farmyard manure is used for the root crops—thirty tons per acre for mangolds, fifteen tons for swedes or turnips (with mineral manures and nitrogenous top dressings in addition). All the arable land is gas-limed, when fallow, some time before cropping, at the rate of three tons per acre, there being no natural lime in the soil. Of the 100 acres of grass land, about sixty are annually dressed with a compost of road dirt, town sweepings, and some yard manure. Lime or gas lime goes to about fifty acres in early winter. Basic slag and superphosphate are used when considered desirable.

The chief feature here is the milking herd—milk being the principal source of income. More than 1,000*l*. worth of milk is sold annually to public institutions, for which the contracts have been held for over thirty years. The management of the dairy herd is very good, and the attention to detail excellent. Mr. Pendock was able to supply detailed costs and returns per cow for both the summer and winter months. Feeding stuffs cost 400*l*. per annum, and labour about 350*l*.

The general management on this farm is very good—the cultivation thorough and the land clean. The crops were good, particularly wheat, oats and mangold, which were excellent. The horses are a useful lot, and the milking cows first rate. The arable land had every appearance of being in fertile condition, and the pastures were well done. Fences and ditches were well kept.

Stretton Court Farm, occupied by Mr. Thomas Andrews, consists of 280 acres arable and 320 grass. The soil is light and is worked on the four course system—roots, barley, clover, wheat. Farmyard manure and dressing the land with sheep form the basis of manuring, artificial manures being applied to supplement the other dressings.

About 130 Hereford bullocks are bought in the spring for grazing and sold out in the autumn, when 120 or more are bought for wintering in the yards and sold out in the spring. Two hundred and fifty pure bred Shropshire ewes are kept, and Mr. Andrews generally succeeds in raising about 360 lambs. If the root crop is good, 150 or 200 more lambs are bought in to help feed them off. About half of the roots are carted off the best land for the cattle in the yards, but on the higher land, which does not receive any farmyard manure, all the root crop is eaten on the land by sheep. There is very little feeding land at Stretton Court; it will carry a good herd of growing stock, however, and two-year-old bullocks do fairly well. The

arable land requires constant manuring. The management here is good, and evidently successful. The cultivations are good and the land clean. Crops good, and pastures well done. Stock good and suitable.

This farm adjoins that of Mr. Francis Hawkins at Sugwas, to which it was placed second in Class V. The competition in this class was very keen indeed, and Mr. Andrews' farm was a very good second. The land and system of farming is so similar to that of the adjoining farm of Mr. Hawkins, that further description is unnecessary.

Great Buckmans Farm, Malvern, occupied by Mr. Walter Meek, consists of 63 acres arable and 108 acres grass. The soil is a strong clay. The principal crops grown are wheat, beans, oats, clover, peas, roots. Red clover is sown under wheat once in seven years, followed by oats, then roots. Dairying is the chief feature, milk selling well in this district. Nearly all the produce is consumed at home, and in addition about 50*l.* of purchased foods annually. The cultivations and crops were very good, and the general management good.

Dormington Court Farm, near Hereford, occupied by Mr. George H. Bray, consists of 22 acres arable, 49 grass, 9 fruit, and 75 hops. The soil is a loamy clay, with stiff clay subsoil. Hop growing is the chief feature here, and splendidly it is carried out. Consideration for space precludes any detailed description, but a few points must be mentioned. The finest qualities of hop only are grown. The hop yards are measured in thirds. That is to say, each winter one-third is dressed with ten tons per acre farmyard manure, another with two tons shoddy per acre, and the remaining third with six cwts. bone meal per acre. The farmyard manure, shoddy, and bone meal are applied to different portions in turn. In addition to the above, the whole of the hop land receives two cwts. per acre of Damaraland guano. The labour bill on this farm last year amounted to 597*l.* for regular labour and 933*l.* for hop-picking labour, or a total of 1,530*l.* on a farm of 150 acres. Surely these figures must emphasise the national value of this branch of agriculture.

This farm is well done throughout, the hop yards particularly so. The two modern hop-drying kilns, erected at the tenant's own expense, are very good, and in keeping with his general endeavour to produce only that which is of the best. The growing hops looked very well indeed, and the land was thoroughly clean.

The competition in this class (VII.) was excellent, and by far the best met with. It required a careful consideration of points to enable the Judges to place the three competitors

Acreage under Crops and Grass and Number of Live Stock in the Counties of Gloucester, Wilts, Hereford, and Worcester, as returned on the 4th June, 1909, with comparison for 1869.

	Gloucester.		Wiltshire		Hereford		Worcester	
	1909	1869	1909	1869	1909	1869	1909	1869
	Acres		Acres		Acres		Acres	
Total Area (excluding water)	803,251		861,366		536,071		476,714	
Total Acreage under Crops and Grass[1]	657,307	632,952	727,124	724,625	449,104	417,462	398,745	383,414
Arable Land	233,789	332,624	273,792	416,450	129,492	191,926	131,927	200,415
Permanent Grass	423,518	300,328	453,332	308,175	319,612	225,536	266,818	182,999
Wheat	44,810	96,491	51,809	102,770	22,179	60,887	27,200	71,926
Barley	24,565	41,524	23,721	65,071	17,151	20,877	6,062	18,524
Oats	30,814	16,907	49,221	32,830	23,670	12,032	18,725	6,971
Rye	230	250	1,819	2,068	138	160	719	771
Beans	8,788	19,391	3,752	13,956	4,144	8,645	11,011	21,825
Peas	2,005	11,237	838	8,607	1,561	7,223	6,887	10,160
Potatoes	3,029	6,273	2,467	3,853	1,457	2,827	6,654	5,991
Turnips and Swedes	26,064	43,009	35,980	68,616	15,433	27,000	7,071	15,863
Mangold	6,501	3,578	9,282	4,255	4,005	1,260	6,234	3,392
Cabbage	674		1,399		162		1,501	
Kohl-Rabi	71	[2]946	505	[2]8,437	21	[2]229	100	[2]587
Rape	423		8,315		220		139	
Vetches or Tares	4,695	[2]—	14,785	[2]—	1,183	[2]—	1,549	[2]—
Lucerne	697	[2]—	734	[2]—	510	[2]—	1,006	[2]—
Hops	25	29	—	1	4,997	5,738	3,054	2,522
Small Fruit	1,567	[3]—	182	[3]—	1,316	[3]—	4,732	[3]—
Clover, Sainfoin, and Grasses under Rotation	72,886	71,715	59,442	66,589	29,891	32,237	20,600	23,127
Other Crops	1,426	[4]11,252	1,191	[4]21,518	209	[4]5,090	3,293	[4]7,752
Bare Fallow	4,519	10,022	8,350	17,879	1,245	7,721	5,390	11,004
Mountain and Heath Land used for Grazing	8,692	[5]—	20,584	[5]—	10,840	[5]—	3,293	[5]—
	No.	No.	No.	No.	No.	No.	No.	No.
Horses used for Agricultural purposes[6]	22,969	[7]—	20,715	[7]—	15,424	[7]—	16,478	[7]—
Unbroken Horses — One year and above	5,041	[7]—	2,845	[7]—	6,008	[7]—	4,019	[7]—
Unbroken Horses — Under one year	1,727	[7]—	1,043	[7]—	2,662	[7]—	1,519	[7]—
TOTAL OF HORSES	29,737	28,545	24,608	25,181	24,094	21,667	22,016	20,956
Cows and Heifers — In milk	35,060		62,923		26,389		22,191	
Cows and Heifers — In calf, but not in milk	10,777	[3]38,095	13,910	[3]50,259	6,968	[3]25,154	6,745	[3]23,281
Other Cattle:—Two years and above	25,615	28,472	11,501	10,585	18,023	18,519	14,776	10,931
" " One year and under two	34,175	[3]38,322	17,807	[3]18,765	25,585	[3]27,689	17,888	[3]14,628
" " Under one year	32,918		18,728		26,662		17,185	
TOTAL OF CATTLE	138,545	104,889	124,869	79,609	103,627	71,362	78,785	48,840
Ewes kept for Breeding	154,280		200,435		150,639		69,391	
Other Sheep:—One year and above	73,364	[3]300,569	83,214	[3]487,788	73,365	[3]226,724	42,999	[3]158,517
" " Under one year	177,505	191,407	207,714	320,870	168,256	141,440	83,992	97,998
TOTAL OF SHEEP	405,149	491,976	491,363	808,658	392,260	368,164	196,382	256,515
Sows kept for Breeding	8,964	[3]—	5,854	[3]—	3,953	[3]—	6,300	[3]—
Other Pigs	60,836	[3]—	47,022	[3]—	21,107	[3]—	35,440	[3]—
TOTAL OF PIGS	69,800	51,889	52,876	56,311	25,060	23,303	41,740	33,869

[1] Not including Mountain and Heath Land. [2] Cabbage, Kohl-Rabi, Rape, Vetches or Tares, and Lucerne were separately distinguished in the schedule, but not in the published figures.
[3] Not separately distinguished. [4] Including Vetches or Tares, Lucerne, and Small Fruit.
[5] Not returned. [6] Including Mares kept for breeding.
[7] Horses were returned in 1869 as "Two years of age and above," and "Under two years of age."

in order of merit. Mr. Bray's farm was an excellent second, and that of Mr. Paget Norbury an equally creditable third. All were good, each presenting marked characteristics.

The Norrest, near Malvern, is occupied by Mr. F. Paget Norbury, and comprises 33 acres arable land, 122 grass (including 18 acres of fruit trees), and 43 acres of hops and fruit. The idea here has been to convert a farm out of condition into a fertile and profitable hop and fruit plantation. Whenever a field is clean and in good heart it is planted either with fruit or hops. There are now 18 acres of hops, 7 of black currants, 6 of loganberries, 6 of bush apple trees, 5 of strawberries, 5 of cordon apples, and about 350 standard apple and cherry trees planted on grass. The cordons are planted amongst hops which will be grubbed up next year, and this winter 5 acres of hops will be planted elsewhere to take the place of those grubbed. Also 3,000 black currants and 2 acres of strawberries will be laid down.

So far Mr. Norbury is quite satisfied with the result of his experiment. He considers the chief essentials to good farming to be clean land, deep cultivation, and the use of artificial manures judiciously selected and applied in conjunction with light dressings of farmyard manure. Whenever stable manure can be purchased at 4*s.* per ton and two journeys per diem can be made, it is considered profitable to buy it.

No expense is spared with regard to spraying, manuring, and cultivations. Whatever is required is given at once. Everything is well done.

The Tables on page 309, which Mr. R. H. Rew, of the Board of Agriculture and Fisheries, has courteously supplied, will doubtless be of interest.

The Judges and the writer desire to express their sincere thanks to the competitors for the courtesy and hospitality so kindly extended to them, and for information readily given when preparing this Report.

WM. H. HOGG.

Woburn Experimental Farm,
Aspley Guise, R.S.O.

We subscribe to the foregoing Report—

JOSHUA BALL,
T. S. MINTON,
HERBERT A. PETO,
WARWICK STUNT.

REPORT OF THE COUNCIL TO THE ANNUAL GENERAL MEETING OF GOVERNORS AND MEMBERS OF THE SOCIETY,

HELD AT THE ROYAL AGRICULTURAL HALL, ISLINGTON,

On WEDNESDAY, December 8, 1909, *at* 3 *p.m.*

THE DUKE OF DEVONSHIRE (Trustee) in the Chair.

1. THE Council have to report that the list of Governors and Members has undergone the following changes during the year which has elapsed since the Annual General Meeting on December 9, 1908 : 6 new Governors and 736 new Members have joined the Society, and 3 Members have been re-instated under By-law 14 ; whilst the deaths of 9 Governors, 97 Life Members, 120 Annual Members have been reported. A total of 37 Members have been struck off the books under By-law 12, owing to absence of addresses; 65 under By-law 13, for arrears of subscription ; and 1 Governor, 1 Life Member, and 234 Annual Members have resigned.

2. During the past year, the Society's losses by death include Earl Egerton of Tatton and Mr. Samuel P. Foster—both of whom had served on its governing body. The late Earl Egerton, who, at the time of his decease, was a Trustee, first became associated with the Society in the year 1871 as a member of the Council, and—with only one exception—had served on that body for a longer period than any of his colleagues. His Lordship filled the office of President in the year 1887, when the Annual Show was held at Newcastle. Mr. Samuel Foster's association with the Society began in 1876, in which year he became a Member. He served on the Council for twenty-six years, from 1879 to 1905, and on many occasions during that period acted as a Steward at the Show.

3. Amongst other Governors and Members whose loss by death, since the last Annual General Meeting, the Society has to deplore, are the Marquis of Ripon, K.G., the Earl of Carysfort, K.P., the Earl of Leicester, K.G. (1843), Lord Amherst of Hackney(1859), Lord Burton, K.C.V.O., Lord Tweedmouth, K.T., the Hon. D. P. Bouverie, the Hon. William M. Jervis, Colonel the Hon. F. C. Morgan (1865), the Hon. E. C. A. Pelham, the Hon. Frederick Strutt, the Hon. G. R. Vernon (1861), Major-General Sir Edward W. Blackett, Bart., C.B., Sir Daniel Cooper, Bart., Sir P. Albert Muntz, Bart, M.P. (Member of Council 1886-1905), Sir Richard Green Price, Bart., Sir A. Cowell Stepney, Bart., Sir Tristram T. Tempest, Bart., Sir George Judd, Sir E. Fitzgerald Law, K.C.M.G., Sir Theodore

Martin, K.C.V.O., K.C.B., Sir John Mark, Lieut.-General Sir H. C. Wilkinson, K.C.B., Mr. Robert S. Bainbridge (1863), Mr. H. O. Lloyd Baker, Mr. Peter Barr, Mr. Joseph Beach, Lieut.-Colonel G. F. Birch (1863), Mr. H. Edgar Birley, Mr. George Blake (Member of Council, 1895-1903), Mr. J. H. Bradwell, Mr. Abel Buckley, Mr. S. Gurney Buxton, Mr. V. D. H. Cary-Elwes, Mr. David Christy, Mr. Charles Clinch (1859), Mr. H. S. Constable, Mr. William Cooper, Mr. George A. Dickson (Chester), Mr. C. T. Edwards, Mr. Frederick Elgar, Mr. A. C. Fountain, Mrs. Hick (Mytton Hall), Mr. Robert Howard (1859), Mr. C. H. Inge (1856), Mr. C. C. Jacobsen (1863), Major-General J. Jago-Trelawny, Mr. Henry P. Jones (1852), Mr. William Lane (1857), Mr. Alex. McGregor (Leigh), Mr. Charles Marshall (Broomhaugh), Mr. C. Morrison (Basildon), Mr. Frederick Munn (1845), Mr. William Nicholson (1864), Mr. Harry Olver, Mr. J. A. Partridge, Mr. J. W. Penfold, Captain J. N. Preston (1862), Mr. Alex. Ramsay, LL.D., Colonel A. Saltmarshe, Mr. C. A. Scott-Murray, Major-General F. E. Sotheby, Mr. John W. Spencer (1860), Mr. William Tait, M.V.O., Mr. Edward Tewson, Mr. Henry Trethewy (1849), Mr. J. Walker (1862), Mr. Henry Waring (1869), Mr. C. H. Williames (1860), Mr. Arthur Wilson (Tranby Croft), Mr. J. S. Wilson (1862), Lieut.-Colonel Halifax Wyatt, Mr. O. S. Wynne (1868), and Mr. George D. Yeoman (1863).

4. The above and other changes bring the total number of Governors and Members now on the Register to 9,920 divided as follows :—

1	Foundation Life Governor (Mr. W. Barrow Simonds);
177	Annual Governors ;
88	Life Governors ;
6,668	Annual Members ;
2,955	Life Members ;
31	Honorary Members ;

9,920 Total number of Governors and Members, as against a total of 9,739 Members on the Register at the time of the last Annual Report.

5. Since the beginning of the current year, Mr. Bowen-Jones, who joined the Council in 1871, has been elected a Trustee in the room of Lord Egerton, deceased, and Mr. C. R. W. Adeane has been appointed a Vice-President. The following ordinary Members of the Council have also been elected to fill vacancies in the representation of the Divisions named : The Hon. J. E. Cross (Cheshire), Mr. W. A. Prout (London), Mr. James L. Luddington (Cambridgeshire), Sir Arthur G. Hazlerigg, Bart. (Leicestershire), and Major-General J. F. Brocklehurst, C.V.O., C.B. (Rutland).

6. The Members of Council who retire by rotation at the forthcoming Annual Meeting are those representing the electoral districts of Group C. As the number of Members resident in both Shropshire and Staffordshire had exceeded 300 on the 1st August last, each of those two Divisions is now entitled, under By-law 83, to *two* representatives. The necessary steps have been taken in both these Divisions for the election of a second Member of Council, and the results will be reported at the Annual Meeting at the same time as the announcement is made with regard to the Divisions of Group C.

7. Under the By-laws, the balance-sheet has to be presented for consideration at the Annual General Meeting. The Council, therefore, beg to submit the balance-sheet for the year 1908 with the Statement of Ordinary Income and Expenditure. These accounts were published in Volume 69 of the Journal issued to members last March, having been duly examined and certified as correct by the Auditors appointed by the Members, and by the professional Accountants employed by the Society.

8. Since the last Annual Meeting the Society's funds have benefited to the extent of 2,000*l.* under the Will of the late Mrs. Mary Bridget Johnston, of Widcombe, Bath.

9. A Special Committee of the Council, appointed, on the recommendation of the Finance Committee, to consider the claims of various Committees for increased Grants, has met several times during the year, and a Sub-Committee has made an investigation into the whole scientific side of the Society's work. As a result of the Special Committee's deliberations, the Council have decided to set aside a further sum of 100*l.* for the improvement of the Society's Journal. This will increase the amount devoted to the Journal to 700*l.*

10. Mr. William Carruthers, F.R.S., who has held the office of Consulting Botanist to the Society since the year 1871, having resigned, Professor R. H. Biffen, M.A., Professor of Agricultural Botany at the University of Cambridge, has been appointed as his successor from the beginning of 1910.

11. In recognition of the valuable services rendered by Mr. Carruthers to the Society during the period of nearly 40 years he has been associated with it, the Council have elected him an Honorary Member, and have resolved to grant him a pension of 100*l.* per annum.

12. The Society was particularly unfortunate this year in the weather during the Seventieth Annual Exhibition held at Gloucester, rain falling more or less heavily on every one of the five days on which it was open to the public. It was, however, pronounced on all sides to be one of the best Shows that has ever been held, and, despite the rain, it was successful in almost

every respect. His Majesty the King graciously favoured the Show with a visit on the Wednesday, and honoured the President and Council by his presence at Luncheon in the Royal Pavilion. His Majesty drove round the Showyard and inspected various exhibits of live stock and implements, stopping to visit the Horticultural Exhibition, which this year was of special excellence.

13. No effort was spared by the Mayor (Mr. James Bruton), Corporation, and Local Committee of Gloucester to make the Show a success, and, taking into consideration the prevailing climatic conditions during the week, it must be a source of the greatest satisfaction that so many as 88,396 persons paid for admission. The Accounts for the Show, duly audited, will be submitted at the Annual Meeting. It is not anticipated that the loss will exceed 330*l*.

14. For the Prize of 100*l*. offered for the best Plant for Drying Hops four firms entered, but one of these withdrew before the commencement of the Trial. The Judges (Messrs. Wallace R. Elgar and John Powell), after completing their inspection of the three plants, which had been kept under observation for about a fortnight, awarded the Prize to Mr. E. G. Shew, of Cold Green, Bosbury, Herefordshire. To defray the expenses of Judging, &c., in connection with the Trials, a special fund was raised amongst persons interested in the Hop industry.

15. The Show of 1910 will take place in Liverpool on the Wavertree Playground, from Tuesday, June 21st, to Saturday, June 25th. The Members of the Royal Lancashire Agricultural Society have agreed to forego their Annual Show for the year; and, having regard to the resolution expressing satisfaction at the Society's proposed visit unanimously passed by the Federation of Lancashire and Cheshire Agricultural Societies, and to the great interest which is being taken in the City, everything points towards a repetition of the success which attended the last Liverpool Show in 1877.

16. The Schedule of Prizes for Live Stock, Poultry, Produce, &c., at the Liverpool Show, which will be issued early in the New Year, will be on a very liberal and comprehensive scale. The Liverpool Local Committee have promised a handsome contribution towards the Prizes, and the Royal Lancashire Agricultural Society have very kindly placed at the Society's disposal several Challenge Cups for Competition at the Liverpool Show. Offers of Champion and other Prizes have been received from the following Breed Societies:—

Shire Horse Society, Clydesdale Horse Society, Hunters' Improvement Society, Polo and Riding Pony Society, Shorthorn Society, Dairy Shorthorn (Coates's Herd Book) Association, Lincolnshire Red Shorthorn

Association, Hereford Herd Book Society, Devon Cattle Breeders' Society, Galloway Cattle Society, Welsh Black Cattle Society, Red Poll Society, Aberdeen-Angus Cattle Society, English Aberdeen-Angus Cattle Association, English Jersey Cattle Society, Oxford Down Sheep Breeders' Association, Shropshire Sheep Breeders' Association, Southdown Sheep Society, Hampshire Down Sheep Breeders' Association, Suffolk Sheep Society, Lincoln Long-Wool Sheep Breeders' Association, Society of Border Leicester Sheep Breeders, Derbyshire Gritstone Sheep Society, Cotswold Sheep Society, Kent or Romney Marsh Sheep Breeders' Association, Exmoor Horn Sheep Breeders' Association, Cheviot Sheep Society, Welsh Mountain Sheep Flock Book Society, British Berkshire Society, and Lincolnshire Curly-Coated Pig Breeders' Association. The Gold Challenge Cup, value 50 guineas, offered for the best Four-in-Hand team was won outright at Gloucester by Miss Ella S. Ross. A member of the Society interested in coaching has, however, presented the Society with a similar cup for competition: the cup to become the absolute property of the Exhibitor winning it twice in succession, or three times in all.

17. Prizes to the value of 450*l.* are offered for the best managed Farms in the following four Classes, the Competition being confined to *bonâ fide* tenant farmers resident in the Counties of Lancashire and Cheshire:—

CLASS I.—Farm, chiefly Arable, of 150 acres or over, exclusive of Fell or Tidal Marsh Land. First Prize, 100*l.* Second Prize, 50*l.*

CLASS II.—Farm, chiefly Arable, of not less than 50 acres and under 150 acres, exclusive of Fell or Tidal Marsh Land. First Prize, 50*l.* Second Prize, 25*l.*

CLASS III.—Stock or Dairy Farm of 150 acres or over, exclusive of Fell or Tidal Marsh Land. First Prize, 100*l.* Second Prize, 50*l.*

CLASS IV.—Stock or Dairy Farm of not less than 50 acres and under 150 acres, exclusive of Fell or Tidal Marsh Land. First Prize, 50*l.* Second Prize, 25*l.*

The Entries close on Friday, December 31st, 1909; and Entry Forms and full particulars can be obtained on application to the Secretary at 16 Bedford Square, London, W.C.

18. In connection with next year's Show the Society are offering their Gold Medal for the best Agricultural Motor. The Machines entered for the trials will be tested for efficiency in carrying out three classes of work, viz., Ploughing and Cultivating, Harvesting, and Traction. Entries for these Trials close on May 2, 1910.

19. An invitation has been accepted by the Council to hold the 1911 Show at Norwich on the Crown Point Estate, which is being lent by Mr. Russell J. Colman, and is the same ground on which the Show of 1886 was held.

20. A pleasing increase in the number of samples analysed in the Society's Laboratory has to be recorded, the number for the past twelve months being 475 as against 410 in 1908. Additional to these were 65 samples of Cider and Perry, and 186 samples of Milk analysed in connection with the Society's Show at Gloucester. The decision of the Council to issue,

from time to time, to members, for their *private* information, accounts of cases of adulteration, misrepresentation, or overcharge which had been brought to the notice of the Chemical Committee, has been received with much satisfaction. Three of such circulars have been issued during the year, and have aroused great interest, and been productive of much good. It is well to record that the practice of adulterating Sharps and other offals with sawdust and gypsum—exposed in the circulars referred to—has now entirely ceased. At the same time other cases, such as one of "Locust and Oil Cake" containing 5½ per cent. of sand; of linseed cake with 5¼ per cent. of sand; of the occurrence of castor-oil bean in feeding materials; and of a "Patent Fertiliser" sold at 70*s.* per ton but not worth 40*s.* per ton, have been duly notified. In the general work of the laboratory the large increase in sales of Soya bean and cake has to be specially mentioned, and the advent of this new and useful feeding material is to be welcomed. At the Seventh International Congress of Applied Chemistry, held in London in May, the Society was represented by Mr. Bowen-Jones, Chairman of the Chemical and Woburn Committee, and by its Consulting Chemist.

21. The work at the Woburn Experimental Farm and Pot-Culture Station has progressed well. The official visit of inspection was held on July 29, and on the day following a visit of members of the Society was organised; this practice, which has been in abeyance for some years, thus being reverted to. In addition, several other visits, such as that of the Northamptonshire Agricultural Society, the Glamorganshire Agricultural Society, and others by private individuals, have taken place. The Field Experiments have included an extensive series on the relative value of the new nitrogenous manures, Calcium Cyanamide and Nitrate of Lime, in comparison with Sulphate of Ammonia and Nitrate of Soda; also a further trial has been given to "Nitro-bacterine," and other methods for inoculating leguminous and other crops, and the experiments with Magnesia on different field crops have been carried a stage further.

At the Pot-Culture Station all the above investigations have been duplicated, in addition to the Hills' Experiments and other work of enquiry. The appendix to the Report of the Royal Commission on Sewage Disposal contains a full account of the Experiments conducted at the Woburn Pot-Culture Station, which have been very material in fixing the value to be attached to sewage sludge. An exhibit from the Pot-Culture Station was, as usual, sent to the Gloucester Show, Mr. Freear, the resident-in-charge at the Station, attending throughout the meeting.

22. Since the beginning of the year, 249 enquiries from Members of the Society have been dealt with by the Consulting Botanist. The seeds were of high quality both as regards purity and germination. A remarkable sample of "hay seeds" was composed of 74 per cent. butter cups, 17 per cent. hard fescue and 9 per cent. Yorkshire Fog. The year having been exceptionally wet has been very favourable to the growth of parasitic fungi—several cases in wheat and oats were investigated, a grass field was very badly attacked by *Puccinia Graminis*, clover suffered from the so-called "clover sickness" caused by the parasitic fungus *Sclerotinia*. Apples, plums, and peaches were investigated for injury by different fungi. Potatoes were badly attacked by various species of fungi in addition to the extensive prevalence of the *Phytophthora infestans*.

23. The wet summer greatly favoured certain insect pests, and some crops, notably oats, suffered to an unusual extent. The most frequent cause was frit-fly, though in some cases failure was due to "tulip-root." Various species of aphis were unusually troublesome during the season, and another conspicuous pest was "leather-jacket." The inquiries received covered a very wide range. Those relating to forest-tree pests showed an increase in number, due, no doubt, to the greater attention recently directed towards forestry. Many applications had reference to animal parasites. The insects complained of as attacking farm and garden crops included some new pests and several which are not usually regarded as seriously injurious.

24. The Board of Agriculture returns show that an unusually large number of outbreaks of anthrax have been reported since the beginning of the year, and it is already certain that the total outbreaks for 1909 will exceed those of any previous year since the passing of the Anthrax Order in 1886. On the other hand, the outbreaks of sheep scab and swine fever indicate an appreciable decline in the prevalence of these diseases. There has also been a notable falling off in the outbreaks of glanders, apparently as the result of the operation of the Glanders and Farcy Order which came into force at the beginning of last year.

25. On the recommendation of the Veterinary Committee, the Council passed a resolution in the following terms at their meeting held on March 3 last: "That the Council of the Royal Agricultural Society strongly approve of the proposal that a Testing Station should, with the approval of the Argentine Government, be established on this side of the water, and that animals passing a test at this station should have free access to Argentina.

26. Mr. Robert W. Hobbs has attended and given evidence before the Board of Agriculture Departmental Committee on Epizootic Abortion.

27. As the result of the examination at the Royal Veterinary College for the Society's Medals for proficiency in Cattle Pathology, including the diseases of Cattle, Sheep, and Pigs, the Silver Medal has been awarded to Mr. B. H. Mellon, of Castlegate, Dundalk, Ireland, and the Bronze Medal to Mr. G. F. Banham, of 32 Rock Road, Cambridge.

28. The Trustees of the "Queen Victoria Gifts" fund have made a grant to the Royal Agricultural Benevolent Institution of 140*l.* for the year 1909, to be distributed in grants of 10*l.* each to the five male candidates, five married couples, and four female candidates, who polled the largest number of votes in their class, and who would not this year receive grants from any other fund in connection with the Royal Agricultural Benevolent Institution. To fill the vacancy caused by the death of Sir Nigel Kingscote, the Duke of Devonshire has been appointed a Trustee of the "Queen Victoria Gifts" Fund.

29. The Tenth Annual Examination for the National Diploma in Agriculture was held at the Leeds University from April 26–29, 1909, when 25 candidates were awarded the Diploma, the first candidate obtaining honours. For list of successful candidates see pp. 319 and 320.

30. The Examination for the National Diploma in Dairying was held this year for English students from September 18-24, at the British Dairy Institute, in the new buildings, adjoining the University College at Reading, which are admirably adapted to the requirements of the Examination. The Examination for Scottish students was again held at the Dairy School for Scotland, Kilmarnock, from September 25 to October 2. Twenty-six candidates were examined at Reading, of whom fifteen passed; and thirty-three candidates at Kilmarnock, of whom twenty-two passed. The names of the successful candidates will be found on pp. 324 and 325.

By Order of the Council,

THOMAS McROW,

Secretary.

16 Bedford Square,
London, W.C.

NATIONAL AGRICULTURAL EXAMINATION BOARD.

I.—REPORT ON THE RESULTS OF THE TENTH EXAMINATION FOR THE NATIONAL DIPLOMA IN AGRICULTURE,

Held at Leeds, April 26 to 29, 1909.

1. The Committee entrusted by the National Agricultural Examination Board with the conduct of the Tenth Annual Examination for the National Diploma in Agriculture report that, by the courtesy of the authorities, the Examination was held at the Leeds University from April 26 to 29, 1909. In all 91 candidates entered, 48 in Part I., and 43 in Part II. Of the candidates who entered this year for Part II.—which comprises the subjects of Practical Agriculture, Agricultural Book-keeping (*or Mensuration and Land Surveying*), Agricultural Chemistry, Agricultural Engineering, and Veterinary Science—four, who failed in one subject of Part I. in 1908, were allowed to take that subject *in conjunction* with the Second Part, and six, who failed in only one subject of Part II. last year, came up for that subject *alone*, in accordance with Regulation 9.

2. The result of the Examination in Part II. was that 25 candidates (including one of the four who were also taking a Part I. subject, and four of the six who came up for one subject only) were successful, and, having now passed both parts of the Examination, are entitled to receive the National Diploma in Agriculture, the first candidate receiving Honours. The names of the Diploma winners, in alphabetical order, are as follows :—

Diploma with Honours.

William Lawson, West of Scotland Agricultural College, Glasgow.

Diploma.

William Borlase, Springfield, Tregolls Road, Truro.
Harry Gerard Bray, Midland Agricultural and Dairy College, Kingston, Derby.
Miss Ammye Selina Brentnall, Harris Institute, Preston.
Claud Curwen, Harris Institute, Preston.
Alexander John Findlay, M.A., Aberdeen University.
Laurence Barnard Foord, Leeds University.
Andrew Thomson Fowlie, Aberdeen and North of Scotland College of Agriculture, Aberdeen.
Percy Alexander Francis, West of Scotland Agricultural College, Glasgow.

NORMAN SHIRLEY GOLDING, Midland Agricultural and Dairy College, Kingston, Derby.
ERIC OXSPRING GREGORY, Leeds University.
CUTHBERT HARRISON, Harris Institute, Preston.
ROGER PARKINSON HOLMES, Harris Institute, Preston.
EDMUND INGHAM, Harris Institute, Preston.
CLAUDE KEITH-MURRAY, University College, Reading.
SYDNEY MACDONALD, West of Scotland Agricultural College, Glasgow.
JAMES WALKER MCGILLIVRAY, Marischal College, Aberdeen.
ALLAN STEWART MCWILLIAM, Harris Institute, Preston.
ALEXANDER MAIN, West of Scotland Agricultural College, Glasgow.
JOHN RIMMER, Harris Institute, Preston.
FREDERICK GEORGE SPRING, Aberdeen University.
EDGAR EDWARD STOKES, University College, Reading.
WILLIAM STRANG, JUN., West of Scotland Agricultural College, Glasgow.
OSCAR ROBERT THORNTON, Leeds University.
ROBERT CECIL WHITTINGHAM, Leeds University.

3. Of the 48 candidates who entered for Part I.—which comprises the subjects of Agricultural Botany, Mensuration and Land Surveying (*or Agricultural Book-keeping*), General Chemistry, Geology, and Agricultural Zoology—5 were candidates who had failed on a previous occasion, and 43 entered for the first time. As the result of the Examination in Part I., 30 candidates (including the 5 who failed previously) succeeded in passing in all the subjects, and are thus entitled to sit for Part II. of the Examination in either 1910 or 1911. Three candidates did not present themselves for examination, and the remaining 15 failed—9 in one subject only.

4. The following are the names of the successful candidates in Part I., placed in alphabetical order :—

FRED BANCROFT, Harris Institute, Preston.
BENJAMIN BUNTING, College of Agriculture, Holmes Chapel, Cheshire.
THOMAS ELSEY CARTER, Midland Agricultural and Dairy College, Kingston, Derby.
REGINALD ARTHUR DALLEY, Harper-Adams Agricultural College, Newport, Salop.
HUGH DAWSON, Aberdeen and North of Scotland College of Agriculture, Aberdeen.
AUSTIN EASTWOOD, Harris Institute, Preston.
NORMAN ROE FOSTER, College of Agriculture, Holmes Chapel, Cheshire.
JAMES BERNARD GARNETT, Leeds University.
ARTHUR GILLOTT, Leeds University.
ALEXANDER GREGG, Technical School, Truro.
JOHN ANGUS GUNN, West of Scotland Agricultural College, Glasgow.
MATTHEW HENDERSON, Leeds University.
JEREMIAH ALFONSO HICKEY, Leeds University.
MATTHEW RANKIN JOHNSTON, Midland Agricultural and Dairy College. Kingston, Derby.
JOSEPH DANIEL LEONARD KESWICK, Leeds University.
JOSEPH MURRAY, West of Scotland Agricultural College, Glasgow.
FRANK CLIVE OSBORNE, Harper-Adams Agricultural College, Newport, Salop.
ROBERT PARK, Harris Institute, Preston.

GABRIEL KINETON PARKES, Harper-Adams Agricultural College, Newport, Salop.
JOHN SAMUEL POWNALL, Leeds University.
DAVID BEATT ROSS, Aberdeen and North of Scotland College of Agriculture, Aberdeen.
WILLIAM ALBERT SCOBY, Leeds University.
SYDNEY SKELTON, South-Eastern Agricultural College, Wye, Kent.
ALEXANDER FRANCIS SMITH, Aberdeen University.
ALLEN LACY TATE, South-Eastern Agricultural College, Wye, Kent.
HERBERT WIGNALL, Harris Institute, Preston.
FRANK WILKINSON, Midland Agricultural and Dairy College, Kingston, Derby.
JAMES WILLIAMS, Aberdeen and North of Scotland College of Agriculture, Aberdeen.
WILLIAM AIREY YATES, Harris Institute, Preston.
JOHN MCDONALD YOUNG, West of Scotland Agricultural College, Glasgow.

5. The reports of the Examiners in the five subjects included in Part I. are as follows :—

1. AGRICULTURAL BOTANY. (200 Marks.)

Professor John Percival, M.A., F.L.S.

The work of the Candidates in this subject was, on the whole, quite satisfactory. The Oral Examination revealed the fact that a few of the Candidates had had insufficient training in practical botany, and lacked first-hand acquaintance with the subject. More than half of them failed to recognise ears of rye and bearded wheat, the inflorescence of a mangel with fruits, smut of barley and samples of cabbage, black mustard, and other comparatively common farm seeds. The knowledge possessed by them was sound enough as far as it went, but better results would have been obtained if they had devoted more time to the subject before presenting themselves for Examination.

2. MENSURATION AND LAND SURVEYING. (200 Marks.)

Mr. H. Trustram Eve, F.S.I.

The plotting of the Field Notes, both of Surveying and Levelling, was, on the whole, done well. Greater attention should be paid to *applied* Surveying after elementary plotting has been conquered. A question was given to test the knowledge of applied Surveying, namely, to divide a Field into Four Small Holdings, but this was only attempted by two Candidates out of forty-four. Answers in Mensuration were, as usual, distinctly good. The knowledge of Ordnance Maps continues to be elementary, and should show some improvement year by year.

3. GENERAL CHEMISTRY. (200 Marks.) Professor W. W. Fisher, M.A.

The quality of the work in General Chemistry, with allied parts of physics, was, on the whole, satisfactory, and the answers showed that the Candidates had reached a fair standard of knowledge in this subject. There were very few bad failures, and from an inspection of the note books, it was seen that practically all the Candidates had gone through a course of practical instruction in some recognised Agricultural Institution. Some of the answers to the questions in Organic Chemistry indicated a very limited knowledge of the compounds mentioned in the schedule, and rather more attention might be devoted to this part of the syllabus.

4. GEOLOGY. (100 Marks.) Dr. John E. Marr, M.A., F.R.S., F.G.S.

The Candidates as a whole showed a competent knowledge of the subject. The knowledge of fossils displayed was, as usual, slight, but, in the opinion of

the Examiner, such knowledge is of little use to Agricultural students. A more serious matter is the difficulty which the Candidates appear to find in studying geological maps. It is very desirable that teachers should explain clearly by the aid of Sopwith's models (copies of which could readily be made), the nature of the outcrops of stratified rocks on uneven ground.

5. AGRICULTURAL ZOOLOGY. (100 Marks.) Prof. J. Arthur Thomson, M.A.

The written papers were, in most cases, quite satisfactory, and only six Candidates out of forty-five made mistakes in identifying or classifying the two specimens supplied. The value—for examining purposes—of including specimens in the written paper was in several cases very obvious, for several Candidates who had made no mistake with the specimens thus supplied, made serious errors in the *vivâ voce* tests, evidently through nervousness. While the Candidates' practical familiarity with insects, worms, and the like has greatly improved during the past five years, it must again be pointed out that many were unable to identify under the microscope such simple and characteristic structures as a trachea or a tapeworm's head.

6. The Examiners in the five subjects included in Part II. report as under :—

6. PRACTICAL AGRICULTURE. (500 Marks.)

Mr. T. A. Dickson, Dr. R. Shirra Gibb, and Professor W. McCracken.

The Examiners were a little disappointed with the standard attained, which fell somewhat short of the average of former years. In their opinion this falling off may be ascribed to two causes :—(1) The considerable proportion of the Candidates who were foreigners possessing an imperfect knowledge of English ; (2) The insufficient foundation upon which the specialised training of many had been built, and their failure in consequence to take full advantage of the teaching which had obviously been placed within their reach. Certain branches of the subject were well understood by the majority of the Candidates, notably dairying, potato growing, and tillage operations generally. On the other hand, their knowledge of sheep management left much to be desired. Most of the Candidates had a good sound grasp of the farming practices of their own parishes, but knew too little of the conditions and practices of other districts to do full credit to the National Diploma in Agriculture.

7. AGRICULTURAL BOOK-KEEPING. (200 Marks.)

William Home Cook, C.A.

Forty-two Candidates presented themselves for examination in this subject, and of these thirty-nine obtained the necessary pass marks. The first question, dealing with the preparation of a Balance Sheet and Profit and Loss Account, was, on the whole, fairly well answered. The second question, which perhaps required a little more originality and thoughtfulness on the part of the Candidate, was not so well answered.

8. AGRICULTURAL CHEMISTRY. (200 Marks.)

Dr. J. Augustus Voelcker, M.A., Ph.D., F.I.C., and Dr. Bernard Dyer, D.Sc., F.I.C.

The examination in this subject was of a somewhat disappointing nature, several of those who had written good papers failing to reach the same standard in the *vivâ voce* part of the examination. On the other hand, several who had not the ability of expressing their ideas well on paper, proved in *vivâ voce* examination to have a much better practical acquaintance with the subject than appeared from their papers. Although eight of the Candidates gained 80 per cent. of the marks allotted, there was no instance of special excellence, and in only one or two cases was there shown much acquaintance

with recent research and writings. Though the number of actual failures in this subject was only five, a considerable number of the Candidates did little more than satisfy the minimum requirements.

9. AGRICULTURAL ENGINEERING. (200 Marks.)

Mr. F. S. Courtney, M.Inst.C.E., M.I.M.E.

Taking the papers of the several Candidates collectively, the average is equal to that of former years, and fewer papers—perhaps from the nature of the questions—were left unfinished. In the selection by the Candidates of the questions to be answered, there has been a careful avoidance of those which necessitated any illustration, and in the majority of cases when anything in the way of sketching was attempted, the result could not be described as satisfactory. It is not in the least necessary to produce a picture, but the very great importance of being able to make a descriptive sketch should certainly receive more attention than seems to have been given to it. I would again suggest to Candidates the desirability of carefully considering the questions before commencing to write, and then to confine their answers to the question put. In many cases the answers were much too diffuse. The replies on the whole were quite satisfactory when they were purely text-book questions, but the *vivâ voce* examination showed that there was considerable scope for improvement in the application of simple rules to practice.

10. VETERINARY SCIENCE. (100 Marks.)

Professor Sir John McFadyean, M.B.

The knowledge of the elementary facts of Veterinary Anatomy and Physiology displayed by the Candidates could scarcely be pronounced satisfactory, and it was certainly below that of recent years.

7. The thanks of the Board are due to the authorities of the Leeds University for their liberality and courtesy in placing the Large Hall and other rooms of the University at the Board's disposal for the Examination; and to the Examiners, for the care and attention they bestowed upon the written answers to the papers set, and upon the *vivâ voce* examination.

JOHN GILLESPIE (*Chairman*). JAMES MACDONALD.

J. MARSHALL DUGDALE. THOMAS McROW.

16 Bedford Square, London, W.C.
June, 1909.

II.—REPORT ON THE RESULTS OF THE FOURTEENTH EXAMINATION FOR THE NATIONAL DIPLOMA IN DAIRYING, 1909.

1. The Fourteenth Annual Examination for the National Diploma in the Science and Practice of Dairying was held in September and October, 1909. The Examination for English candidates was held at the University College and British Dairy Institute, Reading, from September 18 to 24, 1909 ; and for Scottish Candidates at the Dairy School for Scotland, Kilmarnock, from September 25 to October 2, 1909.

2. Twenty-six candidates were examined at the English centre. Of these, the following fifteen satisfied the Examiners, and have therefore been awarded the National Diploma in the Science and Practice of Dairying :—

MISS JESSIE ELIZA CARR ALLWOOD, Midland Agricultural and Dairy College, Kingston, Derby.
MISS MARY BADDILEY, Midland Agricultural and Dairy College, Kingston, Derby.
MISS EVELYN BOWLER, Midland Agricultural and Dairy College, Kingston, Derby.
HARRY GERARD BRAY, Midland Agricultural and Dairy College, Kingston, Derby.
MISS IRIS LILIAN BULL, Eastern Counties Dairy Institute, Ipswich, and British Dairy Institute, Reading.
THOMAS ELSEY CARTER, Midland Agricultural and Dairy College, Kingston, Derby.
MISS RACHEL ANN DAVIES, University College of Wales, Aberystwyth.
MISS ETHEL EDGAR, Hampshire Farm School, Basing, and British Dairy Institute, Reading.
MISS DINAH MYFANWY EVANS, University College of Wales, Aberystwyth.
NORMAN SHIRLEY GOLDING, Midland Agricultural and Dairy College, Kingston, Derby.
MISS ESTHER A. GRIMSHAW, Lancashire County Council Farm, Hutton, Preston.
MISS MARY ELIZABETH HOLMAN, Midland Agricultural and Dairy College, Kingston, Derby.
MATTHEW RANKIN JOHNSTON, Midland Agricultural and Dairy College, Kingston, Derby.
MISS PHYLLIS MANNING, Midland Agricultural and Dairy College, Kingston, Derby.
MISS ESTHER LILWALL ROBINSON, Lancashire County Council Farm, Hutton, Preston.

3. Thirty-three candidates were examined at the Scottish centre, of whom the following twenty-two satisfied the Examiners, and have been awarded the Diploma :—

RICHARD C. BROWN, Garleffan, Cumnock.
LEONARD CHARLES BULMER, Montcliffe, Chambers Road, Southport.
JOHN B. BYRNES, Devon Villa, Newcastle West, Co. Limerick.

MISS JANET I. CALDOW, Stanley Villa, Maxwelltown, Dumfries.
MISS EMELIE FRASER DRYSDALE, 55 Colinton Road, Edinburgh.
REGINALD GOODWIN, Thorncliffe, Sutton, Macclesfield.
MISS KATHERINE MACARTHUR HAY, Ledaig, Hamilton.
MISS AGNES J. HEWETSON, Scales Hall, Calthwaite, Carlisle.
THOMAS LOUDON, Low Overmoor, Darvel.
COLIN McDONALD, Auchterneed, Dingwall.
RODERICK McKENZIE, Glenconvinth, Beauly.
WILLIAM NEWTON, Greenside, Droylsden, Manchester.
ARTHUR WILLIAM PATTEN, B.Sc., Hulne Park Farm, Alnwick.
JOHN POTTS, Whitehurworth, Trimdon Colliery, R.S.O., Co. Durham.
THOMAS KENNEDY REITH, Kennerty Dairy Farm, Peterculter.
HECTOR ALEX. SHAW, Hillhead, Glasgow.
SYDNEY SKELTON, S. E. Agricultural College, Wye, Kent.
ALEX. FRANCIS SMITH, Newhills Manse, Aberdeenshire.
MISS JESSIE TANNOCK, Woodend, Tarbolton, Ayrshire.
JAMES WILLIAMS, Tillymair, Tough, Whitehouse, Aberdeenshire.
JAMES WYLLIE, New Mains, Caerlaverock, Dumfries.
JOHN McDONALD YOUNG, Cathcart Nurseries, Newlands, Glasgow.

4. The Examiner in General Dairying (Mr. John Gilchrist, who acted at both English and Scottish centres) reports that, at both centres, a number of the candidates framed their answers too much on the lines of book knowledge, instead of giving the details showing their practical experience regarding the work of the farm; as for instance—when stating the amount of wages paid on a farm, they put the wages at a certain sum per acre instead of detailing the amount of wages paid in each department or class of work. At the English centre, the knowledge shown in the practical work of butter-making was deficient in regard to quality of grain and texture, and neatness of make-up. Taking the Examination all over, there is an improvement in the general work.

The Examiner again desires to emphasise the fact that candidates would do well to read more carefully all the questions before answering any one of them. This would save considerable repetition in the answers.

5. The Examiner in Cheese-making (Mr. John Benson, who also acted at both centres) states that the Examination at both centres was very successful. A large number of candidates were examined, and on the whole, their general work was much better than that of any previous year during which he had acted as Examiner. Owing to the milk provided for cheese-making purposes at Reading being in a very forward condition as regards ripeness, the skill and resource of the candidates were put to a severe test. But most of those who had to deal with this milk did so successfully, and the Examiner is pleased to see that aspirants for the Diploma are beginning to learn how to deal with milk under abnormal conditions. To make normal milk into cheese is a comparatively easy matter, but when the cheese-maker has to deal with milk in

an abnormal condition, the test is severe. The answers given to the questions in cheese-making were, on the whole, very satisfactory, the candidates this year showing a much wider knowledge of dairying generally than the Examiner has found in previous years. The new premises at Reading lent themselves admirably to the purposes of the Examination. Speaking particularly of the candidates at the Scottish centre, the Examiner is glad to be able to report a very great improvement on the results of last year. Many of the male candidates did splendid work; indeed, the Examiner states that he has seldom met such a fine body of men. They were excellent both in practice and theory, willing workers and enthusiastic, and a credit to all concerned in their training.

6. The Examiner in Chemistry and Bacteriology at the English centre (Dr. J. Augustus Voelcker, M.A., B.Sc.), in his report, states that the results of this part of the examination cannot be regarded as altogether satisfactory. The number of failures was considerable, and only one candidate showed special acquaintance with the subject. The paper work was decidedly inferior to that of the oral part of the examination, but, in both parts alike, while there was a generally fair acquaintance with points in which Dairying was specially concerned, there was distinct failure to deal adequately with the general principles of chemical science.

7. The Examiner in Chemistry and Bacteriology at the Scottish centre (Dr. T. W. Drinkwater, F.R.S.E., F.I.C.), reports that, taken as a whole, the Chemistry questions were fairly well answered, most of the candidates had done some practical laboratory work, and this was in their favour. The Bacteriology portion was not so satisfactory, there was considerable evidence of "cram" in the answers. Very few of the candidates had ever made a culture.

JOHN GILLESPIE,

Chairman.

16 Bedford Square, London, W.C.
November, 1909.

ANNUAL REPORT FOR 1909 OF THE PRINCIPAL OF THE ROYAL VETERINARY COLLEGE.

ANTHRAX.

THE following Table shows the number of outbreaks of this disease, and the total number of animals attacked in each of the last six years:—

Year		Outbreaks		Animals attacked
1904	...	1,049	...	1,589
1905	...	970	...	1,317
1906	...	940	...	1,326
1907	...	1,089	...	1,466
1908	...	1,108	...	1,426
1909	...	1,316	...	1,700

It will be observed that a larger number of outbreaks has been reported during the past year than in any other included in the Table, and in reality they exceed those of any previous year since 1887, when the Anthax Order came into force. Accepting the returns of the Board of Agriculture and Fisheries as approximately correct, it would appear that the disease is now fully twice as prevalent as it was ten years ago, and that it is still on the increase. The probable cause of this increase has been touched upon in several previous Annual Reports, in which it was pointed out that it was scarcely possible to account for the majority of the outbreaks except on the assumption that they had been caused by anthrax spores present in cake, corn, and other feeding-stuffs, and manures, imported from foreign countries in which the disease is at certain seasons of the year very prevalent. It cannot be doubted that upon the whole the measures taken by local authorities to limit the spread of the disease when an outbreak occurs are much more efficient than they were for some time after the introduction of the Anthrax Order, and the small proportion of cases in which several successive outbreaks occur during the same year indicates that the increasing prevalence of the disease is not due to permanent soil contamination or to neglect in dealing with the carcasses of dead animals.

The fact appears to be that the provisions of the Anthrax Order do not strike at all at the main cause of anthrax in

Great Britain, although when properly carried out they are admirable as a means of checking its extension when an outbreak occurs. Probably nothing short of the prohibition of the importation of feeding-stuffs and manures from a considerable number of the countries from which the supplies of these materials are at present drawn would effect any notable reduction in the total annual outbreaks, and it may safely be said that such a remedy would be more costly than the disease.

Anthrax bacilli in milk.—The question whether in cases of anthrax in cows the bacilli are usually present in the milk is obviously one of considerable interest from a public health point of view. Reasoning from the fact that in fatal cases of anthrax in cattle the bacilli are always more or less abundant in the blood everywhere, one would naturally expect that in many, if not all, such cases some of the bacilli must find their way into the udder, but there is no recorded instance in which the presence of the bacilli has been proved in milk taken from the live subject.

On three occasions during the last two years milk withdrawn post-mortem from cows that had died of anthrax was sent to the Laboratory, and in each of these cases the bacilli were so numerous that they could readily be detected on microscopic examination of an ordinary stained cover-glass preparation made from the milk.

At first sight this may be thought to indicate a very serious danger to human beings, and to justify the enforcement of rigorous measures to avert the danger when anthrax breaks out in a herd of dairy cows. In reality one finds that that is the view sometimes taken by medical officers of health and acted upon by the local authorities whom they advise, with the result that an attempt is made to enforce restrictions which are not sanctioned by the Anthrax Order. In truth, however, the danger in this connection is not great, and precautions which are in no way oppressive for the farmer or dairyman can be relied upon to prevent the infection of human beings by means of the milk. In the first place, it must be remembered that the question is not whether the milk present in the udder of a cow dying or already dead from anthrax contains the bacilli, but whether in the ordinary circumstances of an outbreak the bacilli are likely to be present in the milk withdrawn from any of the cows. It is probable that in every fatal case of anthrax in a milch cow the bacilli are present in the milk within the udder at the time of death, but it is also probable that the milk invasion does not occur until the bacilli have begun to multiply in the circulating blood, and it is well known that that is an event which usually precedes death by only an hour or two, or

even less. The precise period at which the blood invasion begins may vary, and the time elapsing between the onset of the invasion and death may also vary, but it is quite certain that no animal maintains a normal temperature after the bacilli have begun to multiply in the blood. It therefore appears to be safe to conclude that there is no reason to anticipate any danger from the milk of an anthrax-infected cow unless the disease has proceeded so far as to cause visible illness or a distinct rise of temperature.

It has sometimes been suggested that, although the bacilli may in many cases have gained access to the udder just before an attack of anthrax proves fatal, the fact involves hardly any danger to milk consumers, because the secretion of milk is practically suppressed at this stage of the illness. It is, however, impossible to assent to that view, for it is quite conceivable that the bacilli might escape into the udder and mingle with the milk accumulated in the milk cistern since the previous milking. Otherwise stated, the infection of the milk might occur when the udder is already full of milk.

The foregoing considerations suggest the precautions that ought to be taken in connection with the milk when an outbreak of anthrax occurs among cows. It is only necessary to see that for a week or ten days after the last preceding case the temperatures of all the cows are taken before each milking, and to withhold the milk of every cow that has a temperature above normal or which presents any other symptom of anthrax infection. To prohibit the sale of milk from all the cows on the infected premises is to do more than is necessary in the interests of public health. Moreover, the shutting up of an entire dairy because one or more of the cows have died from anthrax is not sanctioned by the Anthrax Order, which contains only one provision with regard to milk, viz., that which forbids the removal of the milk of any *diseased cow* from the place in which the cow is or has been kept.

GLANDERS.

The following Table shows the number of outbreaks and individual cases of this disease during the past six years:—

Year		Outbreaks		Animals attacked
1904	...	1,529	...	2,658
1905	...	1,214	...	2,068
1906	...	1,066	...	2,012
1907	...	854	...	1,921
1908	...	789	...	2,421
1909	...	536	...	1,761

A fact in connection with the above figures that obviously stands in need of explanation is the lack of concordance

between the decline in the number of outbreaks, and the decline in the number of animals attacked during the last four years. The disparity is, without doubt, due to the increased employment of mallein, with the object of detecting cases of glanders among the apparently healthy horses known to have been recently exposed to risk of infection, or, in other words, the "in-contact" animals in what are known to be infected studs. For many years after the discovery of the valuable diagnostic properties of mallein, its use was generally restricted to the horses showing outward but indecisive symptoms of glanders, and as a rule no serious attempt was made to stamp out the disease from an infected stud by detecting and destroying or isolating the latent cases among the apparently healthy animals. The effect of this was that when a clinical case of glanders was discovered in a stable, it was destroyed, and provided none of the other horses showed any symptom pointing to glanders the outbreak was considered to be at an end. If another case occurred, even within a short interval, it figured in the returns as a second outbreak, and so on. This plan of dealing with outbreaks was altered by the Glanders Order of 1907, which came into operation on January 1, 1908. The Order gave local authorities power to detain all in-contact horses until the suspicion attaching to them had been removed by the negative result of a mallein test, and to destroy, with compensation, all such in-contact horses that reacted. It was foreseen that an immediate result of this new policy might be an apparent increase in the number of outbreaks during the following year, while an increase in the number of cases detected and slaughtered was practically certain, and, as the above Table shows, the returns for 1908 showed a substantial increase in the number of animals attacked, although there was a slight reduction in the number of outbreaks. It will be observed, however, that a decline both in outbreaks and animals attacked had begun in 1905, and that must be set down to the voluntary adoption by a few of the largest horse-owners in London of the plan of dealing with outbreaks which could not be enforced by local authorities till the beginning of 1908.

The figures for the last year must be regarded as very satisfactory. Compared with 1906, the outbreaks for 1908 show a reduction of nearly 50 per cent., and many large studs are now for the first time free from the disease. Figuratively speaking, the disease is being hunted into a corner, and, although it may be some years before it is completely eradicated, there is good reason to hope for that result at no very distant date.

Swine Fever.

In order to show the present position with regard to swine fever it is necessary to set out the figures relating to the incidence of the disease since 1893 :—

Year	Outbreaks	Pigs slaughtered	Year	Outbreaks	Pigs slaughtered
1894	5,682	56,296	1902	1,688	8,263
1895	6,305	69,931	1903	1,478	7,933
1896	5,166	79,586	1904	1,196	5,603
1897	2,155	40,432	1905	817	3,876
1898	2,514	43,756	1906	1,280	7,359
1899	2,322	30,797	1907	2,336	11,275
1900	1,940	17,933	1908	2,067	14,096
1901	3,140	15,237	1909	1,651	14,316

Between 1879, when swine fever was first scheduled as a contagious disease, and 1893, the disease was dealt with by the local authorities, and during that period the highest number of outbreaks reported in any year was 7,238 (in 1879), and the lowest was 2,748 (in 1892). The largest number of pigs attacked in any of these years was 41,973 (in 1879), and the lowest was 13,957 (in 1892).

The column in the above Table which indicates the varying prevalence of the disease since 1894 is the one headed "outbreaks," and from that it will be seen that, while the operations of the Board of Agriculture appeared to have little effect during the first three years (1894-1896), there was a striking drop in the number of outbreaks in 1897. In 1901, there was a marked recrudescence, followed by a rapid decline, until in 1905 the disease touched its lowest ebb, with a total of 817 outbreaks. During the following two years the outbreaks increased to an alarming extent, and, although there has been a slight improvement during the last two years, the present condition compares unfavourably with that which had been reached in 1903, and is very much worse than that of 1905.

Turning now to the column headed "pigs slaughtered," it has to be observed that this includes not only the actually diseased animals that were killed, but also the apparently healthy pigs slaughtered in consequence of presumed exposure to infection. A glance at the Table will show that the proportion between the number of pigs slaughtered and the number of outbreaks has been far from uniform. Thus between 1894 and 1900, both inclusive, each outbreak entailed on an average the slaughter of thirteen pigs, but between 1901 and 1907, both inclusive, this average was only five. During the first of those periods it was the common practice to slaughter

all pigs which could reasonably be suspected of having been exposed to contagion, and it is worthy of note that this was the time when the greatest reduction in the number of outbreaks was effected. During the second period the slaughter of suspected animals was not rigidly enforced, but a prolonged period of isolation was imposed on such animals after the last detected case of swine fever on the premises, and more severe restrictions on the sale and movements of pigs in areas where the disease was prevalent were also enforced. This modification of the original plan of dealing with the disease of course effected a great saving in the amount payable in compensation to the owners of apparently healthy slaughtered pigs, but it threw a much greater loss on the owner when the disease broke out in large stocks, and greatly interfered with the trade in pigs in badly infected areas. Lastly, and most important of all, as a stamping-out measure this plan proved altogether abortive, and latterly it even failed to hold the disease in check.

In the summer of 1908 the method of dealing with the disease was again modified by allowing a greater freedom of movement (under licence) in infected areas, by ordaining the prompt slaughter of all breeding animals on infected premises, and the strict isolation of the other apparently healthy pigs until such times as they could with least loss to the owner be disposed of by sending them (under licence) to a bacon factory or slaughterhouse. Provided there were no concealment on the part of owners, this method ought in theory to lead eventually to the eradication of the disease, for it is founded on the view that any pig which has been exposed to infection must ever afterwards be regarded as dangerous, and it compels the isolation and slaughter of such animals. It differs from the earlier plan in that it does not compel the immediate slaughter of the apparently healthy "in-contact" pigs, but allows the owner time to fatten them while isolated, and thus avoids claims for compensation.

As 1908 was the first complete year since the new method of dealing with outbreaks was introduced, it is still too early to gauge its effects, but it must reluctantly be confessed that it does not appear to hold out much promise that it will eventually stamp out the disease.

The remark of the late Sir George Brown, that no measures less drastic than those which were applied to cattle plague will ever stamp out swine fever, has often been quoted, and it cannot be denied that the experience of the last fifteen years appears to lend support to that opinion. But cattle plague measures would now be enormously costly, and it is not quite certain that they would succeed within a reasonable

time. The concealment of cattle plague was difficult, and the underhand sale of animals which had been in contact was correspondingly risky; on the other hand, the diagnosis of swine fever is often difficult and frequently impossible during life, while the concealment of actual disease and the sale of suspected pigs can often be practised with but little risk of detection. It is scarcely open to doubt that the disease would ere this have been stamped out had there been no concealment on the part of owners and pig-dealers. Experience in dealing with the contagious diseases of animals shows that there are only two ways of preventing frequent concealment, viz.: (1) to offer such compensation as will in general make it worth the owner's while to report; and (2) to make the penalty for concealment so heavy that few will care to run the risk of detection. At the present time neither of these methods can be said to be in full operation, for under existing arrangements an owner of a large stock of pigs stands to lose heavily even when he gives prompt notice of the existence of swine fever, and in many cases the fines which are inflicted when an owner or dealer is convicted of concealment are so low as to have scarcely any deterrent effect.

Malignant Aphtha of Sheep.

On many occasions during the last seventeen years cases of this disease have been reported to the College, and in some instances diseased animals have been sent alive for examination. It appears to be desirable to call attention to the disease here because, although it is too well known to sheep-breeders and shepherds in many parts of the country, it is rare or unknown in other parts, and when first introduced it may cause serious loss and inconvenience before its powers for mischief are realised.

The disease has received but scanty notice in veterinary literature, probably because the services of veterinary surgeons are only exceptionally requested in connection with ovine complaints unless they happen to be of a more or less deadly character. It is at any rate certain that the disease has long been in existence, for it was observed by the late Professor Simonds as long ago as 1832,[1] and was described by him in his lectures delivered at the Royal Veterinary College. It was attributed by him to what, in the language of the time, was called "depravity of blood," and the alleged causes were bad or improper food, injudicious manuring of crops, and unfavourable weather conditions.

[1] Quoted by Walley, Journal of Comp. Path. and Therapeutics, Vol. I., page 119.

Probably the best account of the disease is the one found in an article by the late Professor Walley,[1] who quoted Simonds to the above effect, but declared his own conviction that the disease was contagious and doubtless due to a micro-organism, though possibly favoured by severe weather.

As there is abundant clinical evidence that the disease is a contagious one, there cannot at the present day be any doubt that it is bacterial or micro-parasitic in its nature, but, as is usually the case with diseased conditions which have their starting point in the skin or lining membrane of the mouth and do not cause internal lesions, there is great difficulty in determining what particular organism is the

Head of lamb affected with malignant aphtha. The lines diverging from A indicate the position of the lesions on the upper and lower lips.

actual cause of the disease. The nature of this difficulty will be understood when it is said that both skin and mucous membranes are always contaminated with bacteria, and that these often invade and multiply abundantly in superficial lesions although not themselves the actual cause of the disease.

Cases of malignant aphtha may be met with at any season of the year, but serious outbreaks are confined to the winter and early spring, and that, no doubt, led to the supposition that bad or severe weather is a factor in the causation of the disease. There is, however, another explanation of the seasonal prevalence of the disease, viz., that the conditions for its spread are most favourable in a flock of ewes and young lambs. Indeed, the disease is very rarely the cause of any serious loss among other classes of sheep.

[1] *Loc. cit.*

Usually, the lesions in lambs are confined to the lips and mouth, and in ewes to the udder and teats, though sores may form on the lips and mouths of ewes also. Unless a very sharp look out be kept, these lesions usually escape detection until they have been converted into raised sores covered by brownish crusts or scabs, but the earliest stage on the skin of the nose or lips is one in which the part becomes swollen, hot, and tender, while at one or more circumscribed raised spots the epidermis becomes rough and slightly moist from escaping liquid. This liquid tends to dry up between and around the roots of the hair, and in this way a distinct scab, or crust, is soon produced. Forcible detachment of the scab exposes a wart-like elevation with a raw red surface, which readily bleeds but soon becomes covered again with a second scab. It has not been possible to follow with the same precision the course of the much rarer lesions on the tongue. On the teats and udder the course is the same as on the lips, but the sores here are often larger and may be converted into ulcers, while healing is retarded by the displacement of the crusts in the act of sucking. The lesions usually attain their full development within a few days or a week, and healing gradually takes place under cover of the scab, which eventually falls off, leaving a hairless spot.

Although the common seats of the disease are those mentioned above, sores are occasionally formed on other parts of the skin in young lambs, and in ewes inside the thighs. The uncomplicated disease is seldom or never fatal, but it often occasions a serious loss of condition through interference with sucking and mastication. When the disease makes its appearance in a flock it may spread rapidly, and, although it is not certain, it appears to be probable, that it is transmitted solely by contact between a sore and healthy skin or mucous membrane. In this way it may spread by the mutual rubbing of noses, or by feeding of diseased and healthy out of a common trough. The lesions on the teats and udders in the ewes appear to be always ascribable to contact with sores on the noses and lips of the previously diseased lambs.

During the past year an exceptionally severe outbreak of this disease occurred in a flock of Hampshire Down ewes and lambs on the Home Farm of Mr. E. W. Stanyforth, Kirk Hammerton Hall, York, and as the reported symptoms were in some respects unusual, a visit was paid to the flock by Professor Macqueen. His investigations showed that the disease was undoubtedly malignant aphtha, but that the mouth and lip lesions were exceptionally severe in the ewes, and in a considerable number of cases were accompanied by foot lesions. The latter usually set in about a week or ten

days after the disease had made its appearance on the lips, the onset being usually sudden and the lameness intense. Examination at this stage showed swelling and tenderness of the coronet, and signs of inflammation or actual suppuration between the claws. The foot infection appeared to have had its starting point in connection with the thin skin between the claws, and when suppuration occurred the abscess formed in the so-called inter-ungulate gland. Recovery generally took place, but in a few cases the inflammation and suppuration spread to the joints of the foot, and the animal had to be destroyed.

It is not easy to say why in this outbreak there were so many severe foot cases, though there is no doubt that in all such cases the primary lesions are those about the mouth, and that the feet become infected through being brought into contact with the sores on the lips.

Recovery from an attack of this disease leaves the animal immune for an undetermined period afterwards. The immunity appears to be acquired before the lesions have actually healed, and this is the probable explanation of the fact that when a pregnant ewe has an attack and immediately afterwards drops her lamb, the latter may contract the disease without causing any infection of the teats or udder.

Treatment of the sores is not very satisfactory, and it is probably best not to attempt it in the case of those about the mouth, as they heal naturally. The most serious lesions are those which form on the teats, for, although these also tend to heal naturally, recovery is much delayed by the mechanical irritation of the lamb's mouth in sucking. Cleanliness and a free use of boracic ointment is probably the best treatment for these. When the disease attacks the foot the latter should be kept as clean as possible, which is best secured by removing the animal to a grass field when practicable. If a definite abscess has formed between the claws it ought to be lanced and the matter pressed out, the foot being afterwards immersed in a dilute solution of carbolic acid or other disinfectant.

Here, as in all other cases, prevention is better than cure. No extensive outbreak can ever occur except through the neglect of precautions, for which the necessity is obvious as soon as it is recognised that the disease is a contagious one. Shepherds should be enjoined to keep a sharp look-out for evidence of the disease before or during the lambing season, and even suspicious cases ought to be promptly removed from the flock. If any treatment is attempted it ought to be entrusted to some other person than the shepherd, for otherwise the hands of the latter may be a source of infection among the young lambs. Lastly, it ought to be remembered

that the disease is one which human beings can contract if matter from a sore on a sheep is brought into contact with a wound or abrasion of the skin.

Sterility in Cows.

Sterility in the bovine, as in other species, has a multitude of causes, and the defects and diseases which prevent conception may affect either sex. It is not proposed to discuss here all the possible causes of unfruitfulness in cows, but merely to call attention to what appears to be the most frequent cause of multiple cases of sterility, meaning thereby the failure of a large proportion of cows in the same herd to breed in the same season in spite of service or opportunity for service by a sound bull. The intention, therefore, is to exclude from consideration not only the occasional cases of temporary sterility which occur from time to time in almost every large herd, but also all those cases, whether few or numerous, in which conception occurs but is followed by abortion.

During recent years in many parts of Switzerland, and also in Germany, sterility among cows has become a positive plague, and in both these countries this has been laid to the charge of a disease which appears to have first attracted attention about twenty years ago. During the last ten years it has become alarmingly frequent over large tracts of country, as is evidenced by the fact that in 1903 about 90 per cent. of the 30,000 cows belonging to the members of one Cattle Society in East Prussia were affected with it. In the previous year an inquiry which was instituted in Switzerland, and which extended to 344 herds, showed that 60 per cent. of the cows had contracted the disease.

The disease in question is now generally known as "infectious granular vaginitis." It is primarily an acute inflammation of the genital passages (vulva and vagina) of the cow, and the almost exclusive method of infection is service by a diseased or contaminated bull. After such a service symptoms of the disease are detectable (when looked for) in from one to three days. These symptoms take the form of slight swelling of the entrance to the genital passages, and congestion of the mucous membrane of the vagina and vulva, accompanied by the formation of a muco-purulent discharge. After a few days this discharge is usually sufficient to cause marked soiling of the under surface of the tail. Very soon after the onset of these first symptoms the mucous membrane of the vulva and vagina assumes a granular appearance, which is attributable to the swelling of the minute lymphoid glands normally present in the depth of the membrane. At first these granules have a reddish congested appearance and a

size about equal to that of a millet seed. Within a day or two they assume a lighter tint, and, according to some authors, they may become converted into vesicles which burst and leave minute ulcers. As a rule, however, the granules persist throughout the whole course of the disease, which generally extends to many weeks or even months. The discharge also persists, but during the later stages it usually becomes glairy or mucoid in character, and is seldom very abundant. In bulls which have served diseased cows a similar inflammatory condition may develop in connection with the penis and sheath, but in the male subject the symptoms are often so slight as to escape notice. Moreover, a bull which has become contaminated by serving a diseased cow may afterwards be capable of transmitting the infection by the act of copulation although the penis and sheath appear normal.

The foregoing account of the disease is based on the account of it given by Continental authors (Hess, Raebiger, and others), and the question may now be asked whether the description applies to any disease of the genital organs observed in cattle in this country. Reports of several outbreaks of contagious vaginitis in cows have within the last two years come to the knowledge of the writer, and during the past year an investigation which was made in order to discover the cause of multiple cases of sterility in one herd left no room for doubt that the barren animals were affected with vaginitis, and the obtainable history made it very probable that the disease had been communicated to them by a particular bull. This and other cases that have come under notice prove that there is in this country an infectious vaginitis of cows, and it is only too probable that it is identical with the one now so prevalent on the Continent. It is well that British breeders should be aware of this, for early recognition of the disease when it is introduced into a herd is of the utmost importance. Sterility of any considerable number of cows or heifers during the same season, or the frequent return of any considerable number of animals to the bull, should always excite suspicion, and lead to a careful examination for signs of vaginitis. Should these be detected the affected cows or heifers should if possible be kept apart from the others, and the bull which has served any of them ought on no account to be used for the service of other animals. Experience has shown that even when treated the disease in female animals often runs a prolonged course, and complete recovery usually requires a period of some months. No animal ought to be regarded as cured until the genital passage has become normal in appearance, all discharge has ceased, and the periods of œstrum are returning at normal intervals.

When a bull is known to be contaminated the sheath and penis ought to be disinfected several times with intervals of a few days, and even then it is always best not to use the animal for service for some weeks. When once a bull has been found to transmit the disease it is never safe to conclude that recovery has taken place until he has served a cow without infecting her.

Finally, when a new bull is introduced into a herd, it is a common-sense precaution to keep a sharp look-out for any indications of vaginitis in the first cow or heifer that he serves.

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ANNUAL REPORT FOR 1909 OF THE CONSULTING CHEMIST.

There has been a satisfactory increase this year in the number of samples sent, for analysis, by Members of the Society. As against 408 in 1908, the number has risen in 1909 to 485. The detailed list of these is given at the end of this Report. In addition there were 186 samples of milk and 65 of cider and perry analysed in connection with the Society's Country Show at Gloucester.

The most marked features of the year as concerns the supply of feeding materials has been a general rise of price in these, particularly in linseed cake, and the introduction of a new article—Soya bean cake. As regards fertilisers there is no great change to record, and the new nitrogenous materials, calcium cyanamide and calcium nitrate, have hardly come as yet into general use in this country.

Reverting to observations made in my last Annual Report, it is satisfactory to state that the practice of gross adulteration of offals then instanced, has, by the adoption of energetic measures, now been put an end to. Attention was drawn to the mixing of sawdust and gypsum and the sale of the mixture under the name "Shudes." Bran, middlings, and other offals were similarly found to be frequently adulterated in this way. After careful establishment of the facts of several cases of adulteration of this kind, prosecutions under the Fertilisers and Feeding Stuffs Act were instituted in different parts of the country and heavy penalties against the principal offending firms were obtained, with the happy result of almost entirely breaking up the traffic in the spurious material. The Royal Agricultural Society of England took a very prominent part in urging on these prosecutions, and it is largely to its exertions that so successful an issue was brought about.

Another matter to which attention was drawn in last years' Report was the difficulty that was impending as regards the future supply of kainit and other forms of potash salts for agricultural use. It is satisfactory, however, to note that the fears on this account have not been to any considerable extent realised this year, and though occasionally (as will be seen in the present Report) potash salts have been met with which were very hygroscopic in character and could not be stored without becoming very moist, yet purchases of kainit of good quality have been procurable fairly throughout the year, although the composition of this has been somewhat different to what it used to be in former times.

Speaking generally, there has been a decided improvement in the quality of feeding materials, and little to object to as regards the ordinary fertilisers used on the farm. When, however, purchasers have been tempted by the inducement of a low price to buy manures with high-sounding titles and put forward as possessing very particular advantages, there has been the oft-repeated need of a note of warning.

The Annual Report of the working of the "Fertilisers and Feeding Stuffs Act" has lately been issued for the year 1908. It shows an increase over 1907 in the number of samples taken; this being for England 2,314 as against 1,933 in 1907, but of these only 618 were "formal" samples, *i.e.*, those in respect of which further steps could, if considered desirable, be taken. Out of this number there were 46 cases which were reported to the Board of Agriculture. In 32 of these the Board took no action, and of the 14 cases in which prosecutions ensued, 12 were successful and 2 failed. The prosecutions were confined to five counties only. This is not a "great" record, though better than nothing; and it is well to note that among the successful prosecutions were several which had to do with the sale of sawdust and gypsum as a substitute for, or adulteration of, offals, and in the exposure of which the Royal Agricultural Society of England had shown itself so energetic. So long, however, as the great objections to the working of the Act continue, so long will it fail to effect the objects of its introduction. Chief among these objections are: (1) the time limit of ten days, (2) the taking away from County Councils of the power, which they formerly possessed, of prosecuting on their own initiative.

In order to keep Members of the Society cognisant of the forms in which adulteration is practised, or to bring to their notice cases of inferiority of quality and the like, while at the same time avoiding the difficulties which might arise under the law of libel, the Council resolved a year ago to issue from time to time to their Members, for the latter's private in-

formation and use only, circulars setting out the principal cases which had been brought to their notice. Three such circulars have been issued during the year, and it is clear that, from the interest aroused by them, they have been productive of much good, and have kept the Members of the Society acquainted with what is going on, and warned as to what to avoid. It is intended to continue the practice of issuing these circulars as occasion presents.

Of new materials the one that has come most prominently into use is Soya bean cake, and this bids fair to largely take the place of other feeding materials, the price of which has been lately enhanced by trade conditions. Among fertilisers there has been hardly anything new ; for it cannot be said that calcium cyanamide and calcium nitrate have as yet found their way into regular supply in this country, or been adopted by the ordinary farmer in the way that he uses sulphate of ammonia or nitrate of soda. That there is, however, a future for both these materials—made by the utilisation of the nitrogen of the atmosphere, and hence from a practically inexhaustible source—must be clearly borne in mind. Experiments carried out during the present season at the Woburn Experimental Farm and elsewhere have proved the practical utility of these ; and that, speaking broadly, the nitrogen contained in them is just as efficacious as it is in the better known forms of sulphate of ammonia and nitrate of soda. The whole question of their employment turns, as I have before pointed out, on the *price* at which the *unit of nitrogen* is procurable in them as compared with the better-known salts. Up to the present the prices of the two new materials have been regulated entirely by the corresponding prices of their older competitors, and one probably does not know yet what it really costs to produce them in merchantable quantities, and consequently at what price they can eventually be offered. I have little doubt, however, from my practical experience with them in the field, that as soon as it can be shown to the farmer that he can buy his nitrogen in these forms more advantageously than he can in the form of sulphate of ammonia or nitrate of soda, he will not be slow to avail himself of them. Until then, however, he is wise to stay his hand.

I now put forward, as usual, the details of matters which have been brought before me in the examination of samples submitted by Members during the year :—

A. Feeding Stuffs.

1. *Linseed Cake.*

The price of linseed cake has risen very considerably, thereby causing it to be to some extent less used, and to be

replaced in measure by Soya bean cake or meal. The instances of inferiority or impurity of cakes sold as linseed cake have been but few. Occasionally, however, such occur, as exemplified in the accompanying analyses ("A," "B," "C"). In the two first-named cakes sand was present in excessive amount, the quality in each case being also low. "C" was an instance of a cake specially low in quality, though pure. Analyses "D" and "E" give a comparison of two cakes, one ("D") a pure linseed cake, and the other ("E") sold as "oil cake," but represented as being equal to best linseed cake, and they show the need of insisting on the purchase of pure linseed cake only.

	A	B	C	D	E
Moisture	12·61	10·98	10·23	12·07	12·92
Oil	8·96	7·75	6·79	14·38	11·28
[1] Albuminous compounds	26·81	27·50	35·37	26·25	22·94
Mucilage, digestible fibre, &c.	35·12	36·21	35·02	41·02	46·55
Woody fibre	8·42	7·92	7·15		
[2] Mineral matter (ash)	8·08	9·64	5·44	6·28	6·31
	100·00	100·00	100·00	100·00	100·00
[1] Containing nitrogen	4·29	4·40	5·66	4·20	3·67
[2] Including sand	2·34	3·34	·05	—	—

"C" was a cake costing 7*l.* 17*s.* 6*d.* per ton in London in January, 1909, the then current price for American-made cake in London being 7*l.* 13*s.* 9*d.* per ton.

"D" cost 9*l.* 15*s.* per ton delivered, and "E" 9*l.* 7*s.* 6*d.* per ton, the respective analyses showing that the "oil cake" "E" was greatly inferior in value. Moreover, while "D" was a pure and good cake, "E" was by no means free from weed seeds.

Hydrocyanic Acid (Prussic Acid) in Linseed Cake.

Though I have specially examined numerous samples of linseed cake in the course of the year for the possible presence of substances capable of developing prussic acid and thereby causing harm to stock, there is only one instance in which I have found this to occur. In the case in question the purchaser noted an unwillingness exhibited by his cattle to take the cake (a new delivery), and, on sending me a sample of it, I found that it certainly did develop prussic acid in measurable quantity. The cake had a distinctly bitter taste and yielded ·022 per cent. of prussic acid, equivalent to 1·51 grains per lb.

This is, however, as I have said, the only instance brought to my notice, and I am of opinion that the possibility of harm arising from this source has been considerably exaggerated.

2. *Cotton Cake (Undecorticated).*

Cotton cake, though its price has somewhat increased, has continued to be, on the whole, of good quality. The class of cotton cake generally known as "Bombay" cake has also mostly been of improved manufacture. Occasionally it still happens that "Bombay" cake is substituted for "Egyptian," but this is exceptional. In one such instance brought to my notice, cake had been sold as "Pure Egyptian 97 per cent." at 6*l.* per ton, but I found it to be made of "Bombay" seed. Though this allegation was at first denied, it was ultimately allowed and the difference of value given. It seems that the Hull firm originally supplying it described it as "made of Egyptian and other seed." All such loose forms of guarantee should be avoided.

3. *Cotton Cake (Decorticated).*

The supply of this has been alike limited and unsatisfactory. One looks now in vain for the prime decorticated cotton cake of the past, which was so valuable an asset to the farm, and there would moreover seem but little hope of a return to the former good quality of cake, the present deliveries being almost without exception hard and badly decorticated. The conditions under which the cake is brought to this country and sold (chiefly at Liverpool) are very unsatisfactory, and provide no real guarantee for the farmer, inasmuch as there exists no limit whatever as to the extent to which fibre may be included, or, in other words, no standard of "decortication." So it comes about that one may meet with a cake or meal sold as "decorticated" but which is really little better than "undecorticated." Such cases were the following :—

	A	B
Moisture	9·48	11·92
Oil	5·92	7·94
[1] Albuminous compounds	22·69	34·87
Soluble carbohydrates, digestible fibre, &c.	32·47	39·34
Woody fibre	21·81	
[2] Mineral matter (ash)	7·63	5·93
	100·00	100·00
[1] Containing nitrogen	3·63	5·58
[2] Including sand.	2·49	·10

"A" was sold at first at 8*l.* per ton, but the purchaser, noting that it was dark coloured and very "husky," declined to give more than 7*l.* per ton for it. On analysis it was found to have excessive sand, to be badly decorticated, and altogether hardly equal to undecorticated cake.

"B" was also very badly decorticated, and contained no less than 25 per cent. of husk; it was stated to be of American "Refuge" brand.

Peruvian Decorticated Cotton Cake.

Several samples of this make of cake have been sent; the analyses of two of these were as follows:—

	A	B
Moisture	9·14	9·73
Oil	12·45	17·08
[1] Albuminous compounds	40·94	38·25
Soluble carbohydrates, digestible fibre, &c.	26·34	23·83
Woody fibre	4·19	4·13
[2] Mineral matter (ash)	6·94	6·98
	100·00	100·00
[1] Containing nitrogen	6·55	6·12
[2] Including sand.	none	·10

These were both of high quality as regards oil, and they were also pure. "A" was rather hard, but a fresh-looking cake; while "B" had a few bits of wool left in it, but was otherwise good.

Nails, Pieces of Iron, &c., in Decorticated Cotton Cake.

Two cases have, during the year, been brought to my notice in which, in a delivery of decorticated cotton cake, have been found nails, pieces of metal, &c., and which are believed to have caused injury to stock. The flattened appearance of the nails, &c., show that they have in most cases passed through the crushing rollers, and hence probably came with the seed. It is the practice of seed crushers to pass their seed, after arrival from foreign ports, over magnets for the purpose of removing extraneous materials such as the above that may get accidentally among the seed. This is generally successful, but occasionally, even with the best exercise of care, some pieces of metal may escape removal and so find their way through the rollers and ultimately into the cake, and, if not noticed, may undoubtedly harm stock. The difficulty is, of course, to prove that injury to stock was actually caused by

foreign material of this kind, and a veterinary examination and certificate is a necessity. But should ever such material be detected in a cake when breaking it up, the delivery should be rejected at once and returned to the vendor.

4. *Soya Bean Cake.*

As mentioned, this cake, made from the Soya bean, which is grown largely in China, and is now being imported mainly from Manchuria, has come very widely into use. It is undoubtedly an acquisition to our list of feeding materials and, if fed with care at first, may safely be used. For milking cows, in particular, I think it likely to do well, and I should consider it as a fitting substitute for decorticated cotton cake rather than for linseed cake, inasmuch as it is, like the former, highly nitrogenous in character, while its oil is not so high in quantity as in linseed cake, nor likely to adequately replace linseed oil as a feeding constituent.

The following analyses represent the composition of the Soya bean and of a fair average sample of the cake as now imported :—

	Soya Bean	Soya Bean Cake
Moisture	10·41	11·40
Oil	17·47	6·12
[1] Albuminous compounds	40·50	42·78
Soluble carbohydrates, &c.	22·38	28·41
Woody fibre	4·21	5·70
[2] Mineral matter (ash)	5·03	5·59
	100·00	100·00
[1] Containing nitrogen	6·48	6·85
[2] Including sand	·20	·37

In addition to the cake, there is also sometimes sold a "Soya bean meal," which has had the oil nearly all extracted by chemical solvents.

So far, I have almost universally found Soya bean cake (or the meal) to be free from adulteration and sound in condition. It is to be hoped that this state of things will continue, and also that the lower price of it (about 6*l.* 10*s.* a ton), which has caused it to replace to some extent other feeding materials, will not undergo much advance.

The question of the manurial value of Soya bean cake has been frequently raised of late, and, having been asked where we would place the cake in our published tables of manurial

and compensation values of feeding stuffs (Journal R.A.S.E., 1902, Vol. 63, pp. 110-1), Mr. A. D. Hall and myself have thought it well to set out our opinion that Soya bean cake should be classed with decorticated cotton cake, to which it is equal, or very nearly so, in manurial value. Further analyses show that Soya bean cake contains, on the average, 1·3 per cent. of phosphoric acid and 2·2 per cent. of potash.

5. *Compound Cakes and Meals.*

As usual, these have been of varied character, some good, some bad. Among the latter was a meal sold as "special meal," and costing 6*l.* 10*s.* per ton.

Moisture	12·23
Oil	3·39
[1] Albuminous compounds	13·25
Starch, soluble carbohydrates, &c.	63·33
Woody fibre	4·86
Mineral matter (ash)	2·94
	100·00
[1] Containing nitrogen	2·12

The analysis shows nothing "special" about this, and the microscopic examination revealed the presence of polygonum, corn-cockle, niger, and other weed seeds in some quantity. The other principal constituents were wheat, oats, and maize, and any intelligent farmer could make up a better mixture for himself, and more cheaply.

6. *Dried Distillers' Grains with Excessive Sand.*

As a rule, dried distillers' grains are found to be clean and good, but one sample was sent me which contained:—

	Per cent.
Mineral matter (ash)	11·18
including sand	9·08

The price was 5*l.* 10*s.* per ton.

7. *Castor Oil Bean in Feeding Materials.*

The presence of castor oil bean in feeding materials has constantly to be guarded against, and, when found, is, I am more than ever convinced (in spite of the assertions made as to the exaggerated importance attached to it), a cause of danger and not improbable loss. In one instance referred to me I found that in a delivery of Soya bean meal came, by accident, one bag of castor-bean meal (intended for manurial use). It was given,

along with other foods, to seven horses; the next day all were taken seriously ill, three dying on the second day, and one on the day after.

8. *Miscellaneous Feeding Materials.*

Camelina cake, Lupins, "Uveco," "Hominy feed."

Analyses of these materials were:—

	Camelina cake
Moisture	8·98
Oil	12·42
[1] Albuminous compounds	35·56
Soluble carbohydrates, digestible fibre, &c.	26·24
Woody fibre	9·62
[2] Mineral matter (ash)	7·18
	100·00
[1] Containing nitrogen	5·69
[2] Including sand	1·95

	Lupins	"Uveco"	"Hominy feed"
Moisture	16·03	11·93	9·63
Oil	5·26	4·63	8·95
[1] Albuminous compounds	33·62	9·50	11·62
Starch, digestible fibre, &c.	42·25	71·07	66·86
Woody fibre		1·53	
[2] Mineral matter (ash)	2·84	1·34	2·94
	100·00	100·00	100·00
[1] Containing nitrogen	5·38	1·52	1·86
[2] Including sand	·05	·04	·14

Camelina cake is made from the seed *Camelina sativa* (Gold of Pleasure), which frequently occurs as an impurity in linseed cake. The cake cost 6*l.* 5*s.* per ton in Hull. It contained too much sand, but in addition I found that it varied much, some pieces sent me being of camelina seed only, while others were made from rape seed, or contained admixture of rape seed.

Lupins are used to some extent for sheep in Norfolk and Suffolk, but they need to be fed very carefully, and should only be given in quite small quantity at first. At best they must be considered rather a "risky" food.

The other two materials were products of maize, and clean and good of their kind.

B. Fertilisers.

1. *Dissolved Bones.*

An excellent sample was the following :—

Moisture	9·58
[1] Organic matter and water of combination	27·10
Monobasic phosphate of lime	10·97
Equal to tribasic phosphate of lime	(17·18)
Insoluble phosphates	19·90
Sulphate of lime, &c.	31·85
Insoluble siliceous matter	·60
	100·00
[1] Containing nitrogen	2·89
Equal to ammonia	3·51

This cost 5*l.* 4*s.* per ton delivered, in Hampshire, and must be considered as excellent value.

2. *Potash Salts.*

A Member sent me a sample of the above which had been invoiced to him as "Kainit (crude potash salts)" at 56*s.* per ton, with a guarantee of its containing 12 per cent. of potash. Its analysis was :—

Moisture	1·26
[1] Sulphate of potash	25·76
Magnesia and soda salts, &c.	72·98
	100·00
[1] Containing potash	13·91

I found this to be very hygroscopic, and after a short time's exposure it became very moist and would have been most difficult to apply to the land. Fuller examination of it showed it to contain considerable amounts of chloride and sulphate of magnesia as well as common salt. Though unlike the kainit of old, the description, "crude potash salts," would, I presume, cover the sale, but purchasers should be on their guard against buying such salts.

3. *Rape Meal with Excessive Sand.*

Rape meal, sold for manurial use, unfortunately often contains excessive sand. One sample sent me had :—

	Per cent.
Sand	12·89

4. *Soot.*

Samples sold under this name are, as I have pointed out before, of very variable origin and quality. One such sent me was the following:—

Moisture	33·17
[1] Organic matter and salts of ammonia	44·95
Oxide of iron, &c.	10·89
Siliceous matter	10·99
	100·00
[1] Containing nitrogen	1·02
Equal to ammonia	1·24

This material cost 26*s.* 6*d.* per ton, a figure greatly in excess of its value.

5. *Lime.*

Attention has, and very rightly, been much directed to the use of lime, and to the value of which the Woburn Experiments so amply testify. It would seem that the attention of traders also is being more directed to the production of good samples both of ordinary and of ground lime. Still, much variation exists among these, as the following analyses show:—

	A	B	C
Lime	91·92	66·57	91·00
Oxide of iron and alumina	1·13	6·37	2·29
Carbonic acid, magnesia, &c.	3·56	6·23	2·27
Insoluble siliceous matter.	3·39	20·83	4·44
	100·00	100·00	100·00

"A" and "C" were excellent samples. The latter came from Sussex, and cost 18*s.* per ton delivered. "B" was much inferior, but still cost 16*s.* per ton delivered, in Shropshire.

The following is an analysis of lime ashes; these cost only 2*s.* 11*d.* per ton delivered, and, though of low quality, must be considered worth getting.

Moisture, loss on heating, &c.	49·43
Lime.	29·62
Oxide of iron, alumina, carbonic acid, &c.	14·27
Insoluble siliceous matter	6·68
	100·00

6. *Tanyard Refuse.*

On a farm in Kent, tanyard refuse was being used, and a sample sent me for analysis gave results as follows :—

Percentage of—	
Moisture	37·50
Mineral matter	8·86
including sand	3·04
Nitrogen	4·55
Equal to ammonia	5·52

The price was 50*s.* per ton, but the material was in bad condition and difficult to handle, so that the price must be considered rather above the real value.

7. *Road Scrapings.*

Where employed for improving the mechanical condition and texture of land, road scrapings may be often advantageously used, but their direct manurial value is, as a rule, but small. This is shown by the following analysis of a sample of road scrapings, a contract having been entered into for the taking of these at the rate of 1*l.* a mile throughout the year :—

Moisture	13·40
[1]Organic matter	3·61
Oxide of iron and alumina	4·13
Lime	·50
Phosphoric acid	·20
Sand	77·33
[1]Containing nitrogen	·086
Equal to ammonia	·104

This, it will be seen, was little better than, if equal to, ordinary soil, so far as concerns manurial value.

C. Miscellaneous.

1. *Magnesia in Soils.*

In my last Report I drew attention to a point which had engaged me for a considerable time, and on which I have carried out, and still am conducting, experiments at the Woburn Experimental Station. I refer to the matter of soils containing magnesia in excess of the lime in them, and in such cases I have frequently, if not universally, found that crops will not

thrive uniformly well. I now append further analyses of soils which illustrate this :—

(Soils dried at 212° F.)	A	B	C	D
Organic matter and loss on heating	5·66	5·05	5·24	11·95
Oxide of iron	2·69	2·36	5·24	5·91
Alumina	4·38	3·85	7·17	6·72
Lime	1·05	·23	·66	·73
Magnesia	1·99	1·53	2·32	·80
Potash	·47	·38	1·72	·39
Soda	·26	·26	1·53	·23
Phosphoric acid	·08	·06	·22	·17
Sulphuric acid	·05	·10	·10	·07
Insoluble silicates and sand	83·37	86·18	75·80	73·03
	100·00	100·00	100·00	100·00
Nitrogen	·114	·234	·154	·418

"A" and "B" were soils from Staffordshire, and it was complained that, though basic slag had been applied and also farmyard manure, the grass would hardly keep any stock on it.

"C" was a soil from Worcestershire, and on it oats would not grow properly. This, indeed, had been the general experience on this field with corn crops during recent years.

Lastly, "D" was from a field in Gloucestershire, and here grass would not grow properly, and the herbage was poor and wiry, containing little or no clover.

2. *Waters.*

(*a*) Water attacking galvanised iron pipes.

(*b*) Water with excessive nitrates.

The analyses of samples such as the above were :—

	A	B
	Grns. per gal.	Grns. per gal.
Total solid residue	16·52	106·40
Oxidisable organic matter	·40	·60
Nitric acid	none	40·60
Chlorine	3·04	2·64
Equal to chloride of sodium	5·01	4·34
Free ammonia	trace	·001
Albuminoid ammonia	·003	·005

In the first case the water came from the edge of the Bagshot sands and the Reading beds. Galvanised iron pipes used for conveying the water were found to be rapidly attacked, and symptoms as of poisoning were produced in those

drinking the water. I found it, on examination, to act strongly on zinc, also on lead, but to only a slight extent on iron.

In the case of the water "B" I was at a loss at first to account for so high a proportion of nitrates, but ultimately I ascertained that the well was sunk in a hop-field on which large quantities of shoddy had been used for many years, the drainage from the shoddy-saturated land, passing, no doubt, into the well.

List of samples analysed on behalf of members of the Society between December 1, 1908, and November 30, 1909 :—

Linseed cakes	39
Undecorticated cotton cakes	26
Decorticated cotton cakes	9
Compound feeding cakes and meals	74
Cereals	31
Rice meal	5
Pea meal	1
Dried grains	4
Superphosphates	22
Dissolved bones	6
Compound manures	15
Raw and steamed bones	12
Peruvian guano	5
Fish, meat, and bone guanos	13
Basic slag	23
Nitrate of soda	3
Sulphate of ammonia	5
Potash salts	7
Shoddy	19
Refuse manures	3
Lime	7
Soot	5
Roots	1
Hay	2
Waters	97
Soils	16
Milk, cream, and butter	12
Sewage sludge	4
Miscellaneous	19
Total	485

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ANNUAL REPORT FOR 1909 OF THE CONSULTING BOTANIST.

THE number of inquiries since the last Report, that is, from December 1, 1908, to December 31, 1909, amounts to 370. The majority of these inquiries dealt with seeds for pastures. One hundred and fifteen samples of different species of grasses were examined and tested, and fourteen samples of clovers also. The quality of these seeds was very satisfactory. More attention is being paid to the kind of plants which should be used in laying down or improving land for golf-courses, tennis-courts, and pastures. Thirty-nine prescriptions have been supplied for such purposes.

WEEDS.

Members were informed as to the names and properties of various weeds, and directions were given how to treat them. Two cases of the appearance of smooth brome grass (*Bromus racemosus* Linn.) in winter oats have been reported on. The strange notion that this grass is a reverting of the cultivated oats to its original form is still entertained by not a few farmers. A case had previously come before me in which the farmer was informed by the seed merchant that the pure oat seed was going back to this its primitive form. In one of the cases submitted to me this year, the sender assured me that the seeds attached to the roots of two plants of brome grass sent were those of the oat, and that a neighbour had obtained a specimen in which a brome grass and an oat grew from the same seed. It is hard to get rid of a wide-spread popular error like this, but the member, when the differences of the two plants were pointed out to him, and he learned that these differences were as great in the vegetable kingdom (though not so obvious) as those between the cow and the sheep in the animal kingdom, was satisfied that the popular notion was an error.

ARGENTINE CERTIFICATES.

Fifteen certificates in regard to the purity of seeds intended to be exported to the Argentine Republic were issued.

PLANT DISEASES.

The diseases investigated presented no novelty; all had been described, and most of them figured in former Reports. Several cases of "clover sickness" caused by *Sclerotinia Trifoliorum* occurred (Journal, 1898, page 753, and 1903, page

376). In one case in which the farmer carried out a six-years' rotation, following wheat, roots, and oats by a three-years' pasture, has this year found the red clover in the pasture entirely destroyed by this fungus, though the neighbouring fields of clover were quite healthy.

Diseases of wheat were found to be caused by *Septoria Graminis*, *Cladosporium Herbarum*, and *Helminthosporium gramineum*. Cases of rust on wheat and grass were examined. The latter occurred in a plot sown in the spring. The grass grew well, but in September it suddenly became quite yellow with the rust spores, while no such disease was detected in the neighbourhood. In the shrubbery not far off there were many Mahonia shrubs, which, like our barberry, is a host of the smut fungus in an earlier stage of its life.

Potato Diseases.

Several fungus attacks of potatoes were examined. Tubers covered with the warts figured in the Journal, 1904, page 264, were received. They supplied no more information as to the cause of the warts than was given in that Report. Specimens of "British Queen" potatoes which were being germinated had the sprouts covered with something white looking like hoar frost. This was found to be due to the spores of a *Fusarium* which had attacked and was destroying the young sprouts. In Staffordshire a field of potatoes was so badly attacked in July by *Macrosporium Solani* that nothing could be done to save the crop. It was too late to gain anything by spraying.

Some apples received in the autumn were being destroyed by bacteria. It was recommended that the injured apples should not be left in the orchard. The injury, often found in apple trees, caused by *Nectria*, was sent from Wiltshire. It was recommended that the diseased branches should be cut away and burned, and the trees should be whitewashed and watched for any spots that might appear, and that these be removed. From the same county were sent leaves of peach and plum attacked by the shot-hole fungus, *Cercospora circumcissa*. It was suggested that the young leaves should, in spring, be sprayed with a dilute solution of ammoniacal copper carbonate.

Poisonous Plants.

Two cases of supposed injury to cows were investigated. A field in Gloucestershire had the reputation of causing abortion. The field was visited and carefully examined. There was nothing in the herbage to account for the evil, and in prosecuting the inquiry no case of abortion was certainly discovered. The origin of the rumour was traced to a former tenant who had got notice to leave. It was recommended that

gravid animals might, without fear of danger, be placed in the field, and so kill the rumour. In the other case cows suddenly became paralysed, and in a few days died. The post-mortem examination showed acute inflammation of stomach and bowels, and this was attributed, of course erroneously, to their eating rye-grass.

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ANNUAL REPORT FOR 1909 OF THE ZOOLOGIST.

CONTENTS.

THE subjects on which the advice of the Zoologist has been asked during the past year have covered a wide range, as may be gathered from the following notes, in which they are grouped under the headings of corn crops, root crops, other farm and garden crops, forest-tree pests, fruit pests, and parasitic diseases of animals.

Any seasonal peculiarities are generally reflected in the applications made to this department, and the past season was noteworthy for the extensive failure of the oat crop, and for the multitude of blight insects which occurred in various plants.

A new asparagus pest is noted, and some rather unusual attacks by already known insect pests are alluded to.

CORN CROPS.

A remarkable feature of the season was the extensive failure of the oat crop, due in most cases to the work of the frit-fly, though eel-worm disease ("tulip root") was also prevalent. Other corn pests do not appear to have been particularly active, though a few cases of wheat-bulb fly, and of corn saw-fly were reported, and the omnivorous "leather-jacket" grubs did considerable harm. An account of the principal corn-crop pests was given in the Zoologist's Report for 1900 (see R.A.S.E. Journal, Vol. 61, page 744).

The difficulty with corn pests is this, that when the presence of the pest is observed the harm is almost invariably already done. No conceivable treatment will restore oat-plants which have been killed by frit-fly maggots. Occasionally, if a crop is seen to be doing badly at an early stage, a dressing of some forcing manure will enable some of the plants attacked to survive the injury done them, and will so minimise the loss, but beyond this, any remedial measures are impossible. Preventive measures, therefore, alone remain, and even here it has to be borne in mind that the pest is by no means certain to recur to the same extent the next season. It may be much reduced by a concomitant increase in the insects which prey upon it, and the weather conditions may not favour it. Still, any measures for its destruction which can be conveniently adopted in the ordinary course of cultivation are clearly desirable, and the first point to be considered is the whereabouts of the pest when the crop is carried—whether the pest is carried away with the crop, or left behind in the stubble. In the case of Hessian fly, for instance, most of the insects are carried from the field in the straw, and quantities of the "flax seeds" may be found and dealt with in the process of threshing. With frit-fly, since the maggot works at the bottom of the stalk, it is the stubble which demands attention. Ploughing it in deeply with a skim coulter is certain to account for such of the flies as are still in the chrysalis state at the time of harvest, but the chrysalis stage is not long, and many will have already emerged to lay their eggs on wild grasses. The only way to destroy the whole brood would be to plough in deeply in June, and this plan should be adopted in the case of very bad attack, where there seems little likelihood of obtaining a crop worth reaping. Finally, early sowing is desirable if weather conditions at all admit of it. It is always the late-sown crops which suffer most.

Root Crops.

The root crop pests inquired about presented few points of special interest. "Leather-jacket" (the grub of the crane-fly, *Tipula oleracea*) was the pest most frequently complained of. It has frequently been dealt with in these Reports, and members may be referred to the Journal for 1908, page 327, for an account of it. There were cases of attack by root-maggots (*Anthomyia*), mangold-fly, turnip gall-weevil, and millipedes. Mangolds appeared to be the crop which suffered most, and it was in connection with these roots that a curious case of "mistaken identity" occurred. A number of beetles sent from a mangold crop proved to be the "sexton beetle," *Necrophorus vestigator*. This insect is, of course, a carrion feeder, and quite harmless to vegetables, and its presence was explained by the fact that

there were a large number of dead moles in the field and the beetles were engaged in burying them to provide food for their grubs.

Another unusual circumstance was an attack on a beet crop by the garden chafer, *Phyllopertha horticola*. This is an insect of very catholic tastes, and well known in the garden, where it eats the leaves of various trees, but I have not previously met with an attack by it upon a farm crop.

Other Farm and Garden Crops.

Most of the pests complained of in this section were *Aphis* or blight insects of various species. Many of them, especially the bean-aphis, were exceedingly troublesome during the past season.

The pea-thrips apparently did much less harm than in the previous year. This might, perhaps, have been anticipated, for thrips attacks are usually most severe in particularly dry weather. Further investigation of such cases as were met with did little more than confirm the observations given in the Zoologist's Report for 1908. Eggs were sought for in vain in any other situation than inside the stamen-sheath of the flowers, but here they could be met with without fail in every case of attack. As before, "topping" the peas as soon as the disease was noticed had a decidedly beneficial effect. In one case a large number of Chalcid flies were observed on the pea flowers. Many of these flies are parasitic on insects, and it is highly likely that these were destroying the thrips grubs by laying eggs in them, though this was not absolutely proved. The peas upon which they were seen were not greatly injured by the thrips, and produced a good crop.

In June some extensive asparagus beds in the north of England were found to be suffering from a pest which appears to be entirely new. This was a "surface caterpillar" which was identified as the larva of the moth *Agrotis præcox*, and the identification was subsequently verified by breeding out some of the caterpillars. Its natural food is the dwarf willow, a plant common in the neighbourhood of the asparagus beds.

Various expedients were suggested and tried, such as the eradication of the food-plant from the immediate neighbourhood, and the use of traps, baited with dwarf willow, placed among the asparagus. The caterpillars, however, seemed to find the succulent asparagus shoots more tempting than the wild food-plant, and continued their depredations. It was not until the plan of admitting chickens to the asparagus beds was tried that much success was attained. They ate the grubs greedily when they were offered to them, and soon began to search for

them on their own account, and the grower believes that they have accounted for a large number of the caterpillars.

An attempt was also made to catch the moths by the use of trap-lamps. As a rule this measure is not advisable, and elaborate investigations by various entomologists have proved it to be in some cases not only useless, but harmful, for the useful insects captured by the lamps often exceed in number those that are injurious, while of the latter, many of those that are caught are either males, or have already laid their eggs. Nevertheless there are cases in which the expedient may be worth trying, and in the present instance circumstances seem to be favourable. These moths belong to a group strongly attracted by light, and the use of the lamps might be confined to the few days during which the majority of the moths emerge. Just at this period it is probable that many of the moths would be caught and comparatively little harm would be done by the trapping of useful insects. Caterpillars bred out in captivity emerged as moths in the middle of August.

In September, some specimens of hop cones were sent for examination with the complaint that much damage was being done by the "strig maggot." In 1891 and 1892 the late Miss Ormerod called attention to this pest, but since that time it seems to have escaped the observation of entomologists. As far as I know, the mature insect whose grub does the injury has not yet been seen and identified. The grub is evidently that of a "midge," a small fly of the same group as the pear-midge (*Cecidomyidæ*). Our present knowledge of the pest amounts to this, that in September hop cones are often seen to wither and turn brown on account of the work of a small maggot which feeds in the "strig" or central stem of the cone, and that these maggots leave the cones towards the end of September and fall to the ground to bury themselves in the soil. As is the case with others of their kind, they have the power of "skipping," and can thus distribute themselves over a fairly wide area. Apparently it is a wet season pest, for severe attacks have nearly always occurred after a particularly rainy summer.

Even this meagre knowledge of the habits of the insect, supplemented by what we know of others of the same group, indicates quite clearly the line which preventive measures must take. Inside the hop cone the grub is invulnerable, and no amount of washing would be likely to disturb it. Nor does there seem to be any hopeful method of preventing the fly from laying its eggs in the cones. Obviously the one chance of destroying it is to treat the soil in some way which shall kill the grubs which have buried themselves in it to turn to chrysalids. The really important point which remains to be

ascertained is whether the chrysalis remains in the soil till the following summer when the hops are again ready to be attacked by the fly, or whether the flies emerge the same autumn and continue their life-history on some other plant. In the former case there is no particular hurry in dealing with the infested soil; in the latter, any treatment, to be effective, would have to be applied as soon as the grubs had gone to earth.

The inquiry reached me too late for much material to be obtained this season. In the specimens sent the grubs were few in number and did not show much life. They were allowed to bury themselves in soil in a muslin-covered vessel, but hitherto (November 10) no flies have emerged. One of Miss Ormerod's correspondents believed that he had derived much benefit by admitting sheep to a badly infested hop-garden, and allowing them to tread down the ground thoroughly.

Forest-tree Pests.

Many applications for advice have had reference to forest-tree pests, including larch-bug, *Lithocolletis* on Holm oaks, *Pemphigus bursarius* on poplars, a saw-fly attack on hawthorn, and a leaf-miner on holly (*Phytomyza ilicis*). Several cases of rather severe attack of winter-moth on ornamental trees were reported. One of the pests most frequently inquired about was the beech-scale, *Cryptococcus fagi*. An ordinary paraffin emulsion was generally effective against this pest, and the wash advocated by Mr. Gillanders proved very efficacious. It is made thus: "Take half a gallon of soft water, boil, and dissolve about 1 lb. of soft soap and about 1 lb. of common soap; add a handful of sulphur, one pint of paraffin, and about the same quantity of turpentine. Then add about four gallons of soft water to this mixture. Churn well with a syringe, and when cold store away in a stoppered barrel to prevent evaporation. Apply with a whitewash brush about May, just as the larvæ are hatching out, but before application churn well with a syringe to ensure the mixture of the ingredients."

Fruit Pests.

The inquiries relating to fruit trees and bushes did not present any features of special interest. Many aphis attacks were complained of, the black cherry aphis being particularly troublesome. Specimens of "big-bud" on black currants were sent, and the pear leaf-blister mite was also reported. The list also included various saw-fly attacks, and some cases of wood-boring pests, particularly the goat-moth and the fruit-tree bark beetle (*Scolytus rugulosus*). The wet season was not calculated to encourage "red-spider," but a few cases of attack on gooseberries (*Bryobia*) came to hand.

Parasitic Diseases of Animals.

A good many of the applications for advice received by the Zoologist related to the diseases of domestic animals, but some of them would have been more properly referred to the Veterinary Department. Cases were reported of "gapes" in pheasants, and of the intestinal worm *Sclerostomum hypostomum* in sheep, as well as of warble-fly and numerous external parasites on various animals. Creatures found living in water to which domestic animals had access were often sent for identification with a view to ascertaining whether they were likely to be harmful. These included certain worms, and the different animals known as "water-fleas" (*Collembola*, *Daphnia*, &c.). In most cases the creatures themselves were innocuous, but they sometimes indicated a somewhat foul condition of the water which rendered it unsuitable for drinking purposes, and it is important to remember that many of the internal parasites to which animals are subject are acquired from polluted water supplies.

A rather interesting worm sometimes sent in this connection is the "Hair-worm," known scientifically as *Gordius*, from the "Gordian knot" into which it ties itself. It is very slender, and about four inches long. Its early life is spent as an internal parasite of certain water insects—the May-fly larva for instance —but when adult it is free-living, and harmless to higher animals. For ages a very curious superstition was current with regard to it; it was believed that a horse's hair, falling into the water, became a hair-worm, and later developed into a serpent.

Miscellaneous Notes.

A correspondent who entertains the belief that wasps are at least as useful as they are injurious, has, during the past summer, taken many wasps' nests and sent me hundreds of the captured wasps to ascertain the species and the kinds of insects which the workers are taking to the nest as food for the young. The detailed results will probably be published elsewhere, but a few notes on the subject will not be out of place in the present report.

To the casual observer the wasp appears to be an unmitigated nuisance, on account of the damage it does to fruit. It is not as generally known as it should be that the wasp-grubs are exclusively reared on insect food, the worker wasps catching insects, chewing them to a pulp, and feeding them into the mouths of the grubs in the cells of the wasps' nest. Consequently, taking the whole life of a wasp, far more insect food than fruit food is devoured, and if it should prove that most of the captured insects were injurious, it would follow that wasps

do a considerable amount of good in a way which generally escapes observation.

The wasps sent were by no means always of the same species ; indeed, four species were identified, *Vespa vulgaris*, *V. germanica*, *V. rufa*, and *V. sylvestris*. The last named generally makes its nest in a tree, but an instance of an underground nest of this species occurred among those taken during the last season.

The nests were taken by the cyanide method, and the dead wasps were in a good condition for examination. Almost all the workers held in their jaws insects in some stage of mastication. Sometimes they were so crushed as to be practically unrecognisable, but in most cases it was at least possible to assign them roughly to their proper groups. In no single instance had the wasps selected a useful insect as prey, and in the majority of cases the insects were positively injurious, including crane-flies, aphides, and quite a considerable number of leaf-hoppers, or "cuckoo-spit" insects.

As usual, there were several inquiries with regard to insects infesting stored products, or making themselves a nuisance in buildings in one way or another. The grain-weevil and its allies, and the timber-boring beetles, were included in this category. In one case complaint was made of a small beetle which caused great annoyance in a dairy, infesting it in large numbers and alighting on the surface of the milk. It was identified as *Typhæa fumata*, and its presence was explained by the storage of hay on the floor above the dairy. These beetles are of constant occurrence in hay-stacks, and the case could only be met by removing the hay from the neighbourhood of the dairy, or by preventing the egress of the beetles from the hay-loft by covering all apertures of communication between the two chambers with screens of fine gauze.

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FIELD EXPERIMENTS, 1909.

BEFORE entering on a detailed description of the several sets of experiments conducted, it is necessary to preface this by a brief statement as to the exceptional character of the harvesting season of 1909, one which has seriously affected the returns and caused them to present results in some respects quite abnormal. The sowing of the corn crops was satisfactorily carried through, and at much about the same time as usual; but this was followed, as every one knows, by an exceptionally sunless spring and summer, together with rainfall which, if not heavy, was very continuous. Under such conditions weeds grew apace, and the keeping down of them, especially on the plots devoted to continuous corn-growing, was a matter of great difficulty. Cold, cheerless weather prevented the proper growth of the corn crops and checked the development of the grain. But this was almost a small item when compared with the weather experienced about the harvesting period.

August opened with a heavy rainfall, ·59 in. falling on the first day; on August 2 there were occasional rainstorms also. Then followed, until August 16, the most beautiful weather experienced all the year, a high temperature prevailing and no rain. It was this period which did so much to save the corn crop, and, but for it, the harvest results would have been deplorable. As it was, farmers were able in some cases to secure a fair sample of wheat though the yield was short.

Unfortunately this fine period was followed by one of almost continuous rain and absence of sunshine. Of the remaining fifteen days of the month twelve were wet, the rainfall reaching ·77 in. on August 17 and ·31 in. on the 25th. Matters were but little improved in September, and when at length the corn crops approached a condition something like ripeness, the harvesting of them was a matter of much difficulty. A great deal had to be cut by hand, and every opportunity afforded by a temporary lull in the adverse conditions had to be taken advantage of to secure the corn crop as could best be done. The result was that the crop could only be stacked in inferior condition, and much of it was damaged by weather. Consequent on this, the grain suffered in the stack greatly, and it took, moreover, long to get it even fairly dry and fit to be threshed. The harvesting of the wheat crop was not finished until September 4, and that of the barley not before September 21. In many cases the sheaves had to be turned over in the field several times before they were fit to cart and stack. The result was shown in the threshing, which could not be begun until December 21. Even then the corn was not properly in order, and the separation of the corn from the straw was a matter of considerable difficulty, so that the results recorded must be taken with some allowance, and do not possess the full accuracy attaching to those hitherto recorded. It is safe to say that such an untoward season for harvesting has not been experienced in the history of the experiments since their commencement. The effects of the bad season were shown very markedly in the valuation of the corn when this was done in January, 1910. The grain was in many cases heated and mouldy, and the proportion of small and "tail" corn was very high. As regards the influence of manures, the most striking point is that nitrate of soda showed itself by increasing the quantity of straw rather than that of grain. The weights of straw, however, must be taken with considerable reserve, owing to its very variable condition in regard to the moisture it held.

CONTINUOUS GROWING OF WHEAT (*STACKYARD FIELD*), 1909 (33RD SEASON).

This, the thirty-third season of experimental work, was the third since the introduction of the changes made at the close of the third cycle of ten years. No further changes were made in the wheat plots with the exception that on plot 2aa the small dressing of 5 cwt. per acre of lime was repeated.

After the usual cleaning and ploughing of the land, farmyard manure was applied to plot 11b on October 8, 1908, and ploughed in. The manure had been made during the previous

winter by cattle in the feeding boxes, and, after being analysed, sufficient was applied to give 100 lb. of ammonia per acre. On October 15, 9 pecks per acre of "Street's Imperial" wheat, which had been obtained from Driffield, Yorks., were drilled, and at the same time the mineral manures were given to the plots to receive them (plots 4, 5, 6, 8, 9, 10a). The wheat was well up by November 5. On plot 2a there was, however, no sign of a crop by the end of the month, and very little on 2aa, 8a, or 8b. Plot 5a also seemed to be failing, while, in striking contrast, plots 2b, 2bb, 5b, 8aa, 8bb, to which lime had been applied in earlier years, showed up well. Even plot 2aa, which had only 5 cwt. per acre of lime, showed some signs of a crop. The limed plots, as before, were marked by the comparative absence of spurry, while, wherever sulphate of ammonia had been used without lime, spurry was very abundant. Frost and snow came at the close of the year and the weak plots got even worse. On the other hand, the farmyard manure plot looked best of all, and the heavier dressing of lime on plot 2bb seemed to be telling. On the plots dressed with nitrate of soda only (3a, 3b), the wheat did not tiller out well, and contrasted badly with plots 6 and 9 where minerals also had been used. Frost and snow came again at the end of February, 1909, followed by rain and cold wet weather generally in March, so that the land was very wet when April came in. Rape dust (nearly 4 cwt. per acre) was spread on plot 10b on March 5, and also sulphate of potash put on plot 11a. On April 15 the first half-dressings of nitrogenous salts were given, and the remainder on May 12. Plot 5b then presented a striking contrast to plot 5a, while plots 8aa and 8bb were a great improvement on the almost bare plots 8a, 8b. The wheat came into bloom by June 28, and at this time the farmyard manure plot (11b) was decidedly the best, the rape dust plot (10b) not looking so well. There was little to choose between 10a and 11a. The absence of sun and warmth, which was so characteristic of the summer of 1909, told greatly against the proper ripening of the crop, and the wheat was much damaged by storms of wind and rain; weeds also asserted themselves very strongly. The cutting of the plots began on August 20, but, owing to bad weather during the harvesting, the carting and stacking could not be done until September 4. Even then, as stated, the crops were not properly dry, and it was not until December 21 that a beginning could be made with the threshing, and this was attended with difficulty owing to the damp state of the straw. The produce is given in Table I., page 366.

On the whole, the yield was better than the very unfavourable season seemed likely to give, it not falling materially below the average of the third cycle of ten years

(1897-1906) since the experiments began. The unmanured produce was $7\frac{3}{4}$ bushels per acre, the highest produce that with farmyard manure, viz., 27·8 bushels of corn with $33\frac{1}{2}$ cwt. of straw per acre, whilst next best was the yield of plot 5b (minerals and sulphate of ammonia, following the application of 1 ton per acre of lime in 1905), this reaching $23\frac{1}{2}$ bushels of corn with 22 cwt. of straw per acre. Rape cake (plot 10b) yielded only 1 bushel of corn less, and the plots here mentioned gave results well in advance of all the remainder.

The influence of nitrate of soda in such a season as that experienced was by no means a favourable one, resulting, as it did, in the production of the most "tail" corn, and the lowest weight per bushel. Comparing plots 3a and 3b, the extra 1 cwt. or so (125 lb.) of nitrate of soda gave only 4 bushels of corn additional. The omission of nitrate of soda on plot 9b for a single year took the produce down to that of the unmanured plot.

With sulphate of ammonia applied, results much as in recent years were obtained, there being an absence of crop, or a reduced crop, when no lime was given, but a fair one in all cases where lime—not less than 10 cwt. to the acre—was applied. Plot 5a (not limed), which in 1908 showed a reduction of 5 bushels as compared with the similar plot 5b (limed), again gave this difference, and this plot is clearly showing the need of lime. It is remarkable that on plot 2b, the influence of lime, 2 tons per acre, put on as far back as 1897 and not since repeated, continues to tell, and that here sulphate of ammonia can still be quite well given. Indeed, plot 2bb, on which the lime application was repeated in 1905, has not as yet given a yield equal to that of 2b. The omission—on plot 8bb—of sulphate of ammonia for a single year gave nothing like the lowering of crop that was experienced when nitrate of soda was omitted.

As between plots 10a and 11a, the use of phosphate on the former would seem, as in 1908, to be more necessary than that of potash.

The duplicate unmanured plots (1 and 7) were very uniform, and minerals only (plot 4) gave, as usual, a slightly lower yield, though in its early stages the corn certainly looked better here.

For reasons already given, too much importance must not be attached to the weights of straw recorded; the straw was in too damp and spoilt a condition to make these really comparable in all cases.

The valuation of the corn was carried out on January 20, 1910 The wheat, as a whole, was reported on as being below average, and as lacking strength and quality. The condition

TABLE I.—*Continuous Growing of Wheat*, 1909 (*33rd Season*).

(Wheat grown year after year on the same land, the manures being applied every year.)

Stackyard Field—Produce per acre.

Plot	Manures per acre	Head corn		Tail corn	Straw, chaff, &c.	Value per quarter on basis of 34s. 6d.
		No. of bush.	Weight per bushel	Weight		
			Lb.	Lb.	C. q. lb.	s. d.
1	Unmanured	7·5	60·7	43	7 3 26	34 0
2a	Sulphate of ammonia (=25 lb. ammonia)	—	—	—	1 2 9	—
2aa	As 2a, with 5 cwt. lime, Jan., 1905, repeated April, 1909 .	—	—	—	4 0 7	—
2b	As 2a, with 2 tons lime, Dec., 1897	13·7	60·0	117	14 2 0	32 0
2bb	As 2b, with 2 tons lime (repeated), Jan., 1905 . .	11·7	58·0	112	14 0 24	31 0
3a	Nitrate of soda (=50 lb. ammonia)	15·6	55·7	201	18 2 6	31 0
3b	Nitrate of soda (=25 lb. ammonia)	11·6	55·7	154	18 3 12	31 0
4	Mineral manures (superphosphate, 3 cwt.; sulphate of potash, ½ cwt.)	6·5	60·7	39	7 1 12	34 0
5a	Mineral manures and sulphate of ammonia (=25 lb. ammonia)	18·4	60·8	95	18 2 0	34 6
5b	As 5a, with 1 ton lime, Jan., 1905	23·5	59·7	95	22 0 8	34 6
6	Mineral manures and nitrate of soda (=25 lb. ammonia) .	13·5	56·5	94	16 0 15	33 0
7	Unmanured	8·0	60·5	46	7 2 16	34 0
8a	Mineral manures and (in alternate years) sulphate of ammonia (=50 lb. ammonia)	2·3[1]	60·0	20	4 2 24	34 0
8aa	As 8a, with 10 cwt. lime, Jan., 1905	18·3[1]	59·7	129	18 0 15	34 0
8b	Mineral manures, sulphate of ammonia (=50 lb. ammonia) omitted (in alternate years).	2·8[2]	62·0	24	4 1 0	34 0
8bb	As 8b, with 10 cwt. lime, Jan., 1905	18·3[2]	61·2	84	16 1 17	34 6
9a	Mineral manures and (in alternate years) nitrate of soda (=50 lb. ammonia) . .	14·2[1]	56·7	105	17 0 16	33 0
9b	Mineral manures, nitrate of soda (=50 lb. ammonia) omitted (in alternate years).	7·0[2]	60·6	48	9 0 6	33 0
10a	Superphosphate 3 cwt., nitrate of soda (=25 lb. ammonia) .	13·5	57·7	118	14 1 24	33 0
10b	Rape dust (=25 lb. ammonia).	22·5	60·2	106	20 1 25	34 0
11a	Sulphate of potash 1 cwt., nitrate of soda (=25 lb. ammonia).	11·1	58·5	41	13 1 12	33 0
11b	Farmyard manure (=100 lb. ammonia)	27·8	58·1	43	33 2 12	33 0

TABLE II.—*Continuous Growing of Barley*, 1909 (*33rd Season*).

(Barley grown year after year on the same land, the manures being applied every year.)

Stackyard Field—Produce per acre.

Plot	Manures per acre	Head corn		Tail corn	Straw, chaff, &c.	Value per quarter on basis of 29*s.*
		No. of bush.	Weight per bush.	Weight		
			Lb.	Lb.	C. q. lb.	*s.* *d.*
1	Unmanured	8·2	47·2	37	8 1 2	16 0
2a	Sulphate of ammonia (=25 lb. ammonia)	—	—	—	0 2 8	—
2aa	As 2a, with 5 cwt. lime, Mar., 1905, repeated April, 1909 .	6·6	52·0	20	6 3 9	23 0
2b	As 2a, with 2 tons lime, Dec., 1897	11·9	50·0	32	11 3 25	22 0
2bb	As 2b, with 2 tons lime (repeated), Mar., 1905 . .	30·6	49·7	221	15 2 20	22 0
3a	Nitrate of soda(=50 lb.ammonia)	15·9	51·0	227	20 1 27	22 6
3b	Nitrate of soda(=25 lb.ammonia)	14·6	50·7	276	14 2 5	22 6
4	Mineral manures (superphosphate 3 cwt., sulphate of potash ½ cwt.) . . .	7·7	47·7	77	12 3 6	16 0
5a	Mineral manures and sulphate of ammonia (=25 lb.ammonia)	2·4	52·0	12	1 3 13	23 0
5aa	As 5a, with 1 ton lime, Mar., 1905	28·8	51·0	298	25 0 16	22 0
5b	As 5a, with 2 tons lime, Dec., 1897	27·7	50·7	184	23 2 12	20 0
6	Mineral manures and nitrate of soda (=25 lb. ammonia) .	27·2	51·0	162	24 3 5	22 0
7	Unmanured	7·9	50·0	20	7 3 16	20 0
8a	Mineral manures and (in alternate years) sulphate of ammonia (=50 lb. ammonia) .	7·2[1]	46·9	24	4 2 11	16 0
8aa	As 8a, with 2 tons lime, Dec., 1897	27·8[1]	50·3	88	18 3 7	20 0
8b	Mineral manures, sulphate of ammonia (=50 lb. ammonia) omitted (in alternate years).	5·2[2]	48·0	12	4 0 3	16 0
8bb	As 8b, with 2 tons lime, Dec., 1897	17·2[2]	49·5	60	15 3 25	20 0
9a	Mineral manures and (in alternate years) nitrate of soda (=50 lb. ammonia) . .	34·4[1]	50·5	87	36 1 18	22 0
9b	Mineral manures, nitrate of soda (=50 lb. ammonia) omitted (in alternate years).	22·3[2]	49·9	79	15 2 3	23 0
10a	Superphosphate 3 cwt., nitrate of soda (=25 lb. ammonia) .	22·4	50·5	82	19 2 2	23 0
10b	Rape dust (=25 lb. ammonia) .	24·0	50·4	92	17 0 19	23 0
11a	Sulphate of potash 1 cwt., nitrate of soda (=25 lb. ammonia)	36·9	50·2	131	34 3 5	22 6
11b	Farmyard manure (=100 lb. ammonia)	45·4	51·8	106	37 0 11	24 0

of the corn, however, being generally good for the season, rather higher values were attached to it than would otherwise have been the case. On a basis of 34*s.* 6*d.* per quarter of 504 lb. weight, the best plots were those where sulphate of ammonia had been used along with minerals and lime, or which had been unmanured, or else treated with minerals only; after these came the rape dust plot. The nitrate of soda plots were markedly inferior, and the wheat from some of them would not have been taken at all by millers. The farmyard manure lot had so much sprouted corn that it lost in value, otherwise it would have stood higher in the scale.

Continuous Growing of Barley (*Stackyard Field*), 1909 (33rd Season).

In these, as in the wheat experiments just recorded, the only change of plan was the repetition of 5 cwt. per acre of lime upon plot 2aa. The first ploughing of the land was done in October, 1908, and the second on March 19-23, 1909. Spurry was very abundant on many of the plots throughout the winter, notably on plots 2a, 2aa, 5a, 8a, and 8b; there was less on 2b, still less on 2bb, and hardly any on 5aa, 8aa, and 8bb, these being limed plots. Farmyard manure, made by bullocks in the feeding boxes, was spread on plot 11b on March 18, 1909, supplying (as ascertained by analysis) 100 lb. per acre of ammonia. On April 12, after ploughing and harrowing of the land, 9 pecks per acre of "Goldthorpe" barley were drilled, and mineral manures were applied on April 14 to plots 4, 5, 6, 8, 9, 10a, and 11a. On the same day rape dust was spread on plot 10b.

The barley came up by April 28, and seemed stronger than usual. On May 12 the first half-dressings of the nitrogenous salts were given to plots 3a, 8a, 8aa, and 9a, the second halves going on on May 20, together with the single dressings for plots 2a, 2aa, 2b, 2bb, 3b, 5a, 5aa, 5b, 6, 10a, and 11a.

As in the case of the wheat, the farmyard manure plot (11b) looked much the best, and then came 10b (rape dust). Plots 2a, 2aa, 5a, 8a, and 8b were almost blank, and plot 2b (lime last applied in 1897) was evidently failing fast, for plot 2bb (lime repeated in 1905) looked quite well and spurry was almost entirely absent. Plot 5b was showing a good deal of spurry, and it is clear, from the appearance of plots 2b and 5b, as compared with plots 2bb and 5aa, that the 2 tons per acre of lime applied in 1897 are getting nearly "worked out." A characteristic of all the plots was the shortness of the straw.

The sunless summer, with much rain, did not help to ripen the barley nicely, and even the fine fortnight in August was not sufficient, so that it was not until September 14 that the crop

could be cut. Continuous bad weather delayed the stacking, and the sheaves had to be frequently turned over to dry them. Carting and stacking could not be done until September 21, and it was December 22 before the threshing could be begun.

The produce is given in Table II., page 367.

The crop, though in bad condition and the straw in many cases much rotted, was, on the whole, good in weight, and the highest yield—from farmyard manure—was 45½ bushels of corn with 37 cwt. of straw per acre, and thus above the average of the previous ten-year periods and greatly in excess of the crop of 1908.

The unmanured produce was 8 bushels per acre, and that of minerals only (plot 4) slightly less.

Nitrate of soda alone gave a poor yield, the extra 1 cwt. per acre used on plot 3a showing little more than an increase in straw. The better produce of plot 6 (nearly 13 bushels more) proves the advantage of using minerals along with nitrate of soda. On the other hand, the omission of nitrate of soda for a year (plot 9b) did not give the great lowering of crop noticed in the case of the wheat.

With sulphate of ammonia, results much on former lines were obtained. On plots 2a, 5a, 8a, and 8b there was hardly any crop to speak of. The light dressing of 5 cwt. per acre of lime gave a small crop of 6½ bushels, and, though the influence of the lime on plot 2b (last applied in 1897) is going off, 12 bushels per acre were still obtained, and on plot 5b as much as 27¾ bushels. The further application of 2 tons per acre of lime on plot 2bb, and of 1 ton in 1905 on plot 5aa, gave respectively 30·6 bushels and 28·8 bushels, while 27·8 bushels were yielded on plot 8aa, though lime had not gone on since 1897.

As between the use of superphosphate (plot 10a) and of sulphate of potash (plot 11a) a marked benefit attended the latter, the increase being as much as 14½ bushels.

Rape dust (plot 10b) did only fairly, and was much below the farmyard manure yield.

The grain was valued on January 19, 1910, on a basis of 29*s*. per quarter of 448 lb. It was all found to be of very poor quality, and only one sample (plot 11b, farmyard manure) came anywhere near a malting standard. The fact that feeding stuffs generally were dear, caused a higher value to be put on the grain than would otherwise have been the case. Even the second best samples had bad corns in them, and were of no use for malting. Those coming lower down in the scale were badly weathered, and in some cases had much mouldy and rotten corn. It is noticeable that farmyard manure gave by no means a high amount of "tail" corn, while the weight per bushel was quite good also.

ROTATION EXPERIMENTS (*STACKYARD FIELD*), 1909.

The arrangement of these experiments continued as previously. On the upper half the decorticated cotton cake and maize meal (the manurial values of which during a rotation are being compared) were respectively fed to sheep when eating off the swedes grown on the land, while, on the lower half, the cake and meal respectively were given to bullocks making manure in the feeding boxes, the dung being subsequently applied as a dressing for the swede crop.

The position in 1909, as regards the several rotations (of which there are four distinct ones), was—

UPPER HALF (Sheep feeding-off Roots).

Rotation I.	Crop in 1909.	Swedes, being the *fourth* crop since the commencement of the new plan.
,, II.	,, ,,	Mustard, being the *second* crop since the commencement of the new plan.
,, III.	,, ,,	Wheat, being the *third* crop since the commencement of the new plan.
,, IV.	,, ,,	Barley, being the *fifth* crop since the commencement of the new plan, and the *first* of a new rotation course.

LOWER HALF (Dung made by Bullocks and applied to Swede Crop).

Rotation I.	Crop in 1909.	Swedes, being the *first* crop of the new rotation plan.
,, II.	,, ,,	Mustard, being the *third* crop of the new rotation plan.
,, III.	,, ,,	Wheat (new rotation plan not yet begun).
,, IV.	,, ,,	Barley, being the *second* crop of the new rotation plan.

It may be well to repeat here that the object of the experiment is to ascertain, by the two systems of (*a*) feeding cake or corn on the land to sheep, (*b*) manuring the swede crop with dung made at home by bullocks consuming cake or corn respectively, what the difference of manurial value is between the cake (decorticated cotton cake) and corn (maize meal) as tested by the crops actually grown in the course of a four years' rotation.

It will be seen that, in 1909, on the upper half (sheep-feeding) the first rotation course came to a close on Rotation I., that Rotation IV. concluded this in 1908, but that on Rotations II. and III. the course is not yet completed. On the lower half (dung applied to swede crop) in no case was the first rotation course concluded by the year 1909.

Rotation I. 1909, *Swedes—after Wheat* (1908).

There was so much spurry left on the land after the removal of the wheat crop that it was decided to lime this

entire rotation, and lime at the rate of 2 tons per acre was put on April 3-4, 1909. Previous to this the land had been ploughed, December 22-28, 1908, and a second time on January 4, 1909. On June 8 "Invicta" swede seed was drilled all over the rotation.

(*a*) UPPER HALF (Sheep-feeding).

On this half the swede seed was drilled with 4 cwts. per acre of basic superphosphate and 1 cwt. per acre of sulphate of potash. A good plant came, and was singled July 10-30. Early, however, in August the swedes showed signs of "going off," and this increased as time went on, "finger and toe" being very marked and causing considerable "blanks" in the crop. The swedes were left until December 6, when they were pulled up, the weights being subsequently taken. These are given in Table III.

(*b*) LOWER HALF (Bullock-feeding).

The farmyard manure, made by bullocks during the previous winter, and then stored, well covered with earth, was carted out and spread May 25-28, 1909, after which it was ploughed in. Plot 5 had dung made with decorticated cotton cake, plot 6 that made with maize meal, while plots 7 and 8 had dung made with roots, chaff, and hay only. The weight actually applied was 4 tons per acre. Swede seed was drilled, as stated, on June 8. The swede crop on this half was decidedly better than on the upper half, and "finger and toe," though not absent altogether, was not nearly so prevalent.

The results are given in Table III.

TABLE III.—*Rotation I. Swedes*, 1909.

Stackyard Field.

Plot	Produce of roots per acre	T.	c.	q.	lb.
	UPPER HALF (Sheep-feeding).				
1	Decorticated cotton cake plot (last fed in 1906)	7	5	0	10
2	Maize meal plot (last fed in 1906) .	8	18	1	6
3	No cake or corn ,, ,, .	10	18	2	22
4	No cake or corn ,, ,, .	6	11	1	2
	LOWER HALF (Bullock-feeding).				
5	Swedes manured with decorticated cotton cake dung, 1909 . . .	10	12	2	0
6	Swedes manured with maize meal dung, 1909	13	2	3	12
7	Swedes manured with dung made without cake or corn, 1909 . .	15	2	1	20
8	Swedes manured with dung made without cake or corn, 1909 . .	15	11	2	24

It will be noticed that neither in the upper half nor the lower was there anything to bring out the believed superiority of the cotton cake, whether fed directly on the land or whether put on in the form of farmyard manure. The inequalities in the duplicate plots 3 and 4 were due to "finger and toe," which, indeed, affected the yields of plots 1 to 4 throughout.

Rotation II. 1909, *Green crop (Mustard)—after Barley* (1908).

The land was ploughed at the end of October and beginning of November, 1908, and again June 5-9, 1909. Lime at the rate of 2 tons per acre was spread over the whole rotation April 5-7, 1909. On July 20 white mustard seed was drilled, but the crop came up very patchily, and on August 16 fresh seed was drilled where the first crop had failed. This came better, and the crop was cut, carted and weighed September 16-17. The results are given in Table IV.

TABLE IV.—*Rotation II. Mustard*, 1909.

Stackyard Field.—Green Produce per acre.

	Plot	Upper half (sheep feeding)				Plot	Lower half (bullock-feeding)			
		T.	c.	q.	lb.		T.	c.	q.	lb.
After barley—decorticated cotton cake plot . .	1	3	14	2	14	5	5	5	2	0
After barley—maize meal plot	2	1	19	3	14	6	5	3	2	0
After barley—no cake or corn plot . . .	3	1	15	3	14	7	3	16	2	0
After barley—no cake or corn plot . . .	4	1	12	2	0	8	3	9	3	0

Though the crop was irregular and patchy, the cake manuring (given in 1907) would appear to have "told" on both halves.

Rotation III. 1909, *Wheat—after Mustard* (1908).

The land on which mustard had been grown in 1908 was ploughed October 8-13, 1908, and prepared for wheat, which was drilled October 14, 9 pecks per acre of "Street's Imperial" wheat, obtained from Driffield, Yorks, being sown. Early in 1909 the wheat looked fairly well, but was markedly better on the upper (sheep-fed) half than on the lower half. The crop was cut August 19, but, owing to bad weather, could not be carted and stacked until September 7. The harvest results quite bore out the appearances of the different plots. These results are given in Table V.

TABLE V.—*Rotation III. Wheat*, 1909.

Stackyard Field—Produce per acre.

Plot		Head corn Weight			Head corn Bush.	Head corn Weight per bushel	Tail corn Weight	Straw, chaff, &c.			Value of corn per quarter on basis of 34*s*. 6*d*.	
	UPPER HALF (Sheep-feeding).	C.	q.	lb.		Lb.	Lb.	C.	q.	lb.	*s.*	*d.*
1	Decorticated cotton cake plot . .	9	0	10	18·3	55·6	117	18	0	14	31	0
2	Maize meal plot .	10	2	7	21·6	54·8	114	18	3	10	31	0
3	No cake or corn .	11	2	10	22·7	57·0	74	18	2	18	32	0
4	No cake or corn .	12	2	15	24·3	58·2	111	20	1	11	34	0
	LOWER HALF (Bullock-feeding).											
5	No manure . .	4	1	24	8·9	55·9	91	10	2	0	34	6
6	No manure . .	7	0	1	13·7	58·1	79	12	2	24	34	6
7	No manure . .	8	2	7	16·2	59·3	76	15	1	11	34	0
8	No manure . .	7	3	14	15·5	56·8	74	15	0	9	33	0

On the upper half (sheep-feeding), the wheat being the third crop since the cake and corn were fed on in 1906, there appeared to be nothing left to show the believed superiority of the cake-feeding. Plot 2, on which maize meal had been fed in 1906, gave a larger return, and the feeding without cake or corn still higher results. It is significant, however, that on the cake and corn plots the yield of straw was proportionately higher.

Coming to the lower half, the crop was, as appeared likely to be the case during the growing time, much smaller. But it has to be remembered that this half of the rotation has not as yet had any farmyard manuring, and will only receive its first application with the swede crop of 1910.

When the wheat came to be valued, that of the unmanured plots, 5, 6, and 7, was about the best on the farm, and was considerably better than any grown on the continuous wheat plots. That from the cake and corn fed plots, 1 and 2, was distinctly inferior in condition, and contained much "sprouted" corn.

Rotation IV. 1909, *Barley—after Swedes* (1908).

On the upper half, the swede crop of 1908, which amounted to about 10 tons per acre, was supplemented so that roots at the rate of 12 tons per acre could be fed off on each plot. The feeding with sheep (120) began on February 4, 1909, and these had, as additional foods, on plot 1, decorticated cotton

cake (920 lb. per acre, or about ½ lb. per sheep per day) with a little (1½ cwt. per acre) clover hay chaff; on plot 2, maize meal (920 lb. per acre) with clover hay chaff; on plots 3 and 4, the roots along with clover hay chaff, but with neither cake nor corn. The feeding-on of the roots continued until March 24, the land being ploughed up as the sheep moved on.

On the lower half, the sheep ate off the swedes (12 tons per acre) with a little clover hay chaff, but with neither cake nor corn. The reason for doing this, though cake and corn-made manure had been previously used on the land, was that otherwise the land would have lost the "treading" which experience has shown, on land of this light character, to be invaluable for getting a subsequent barley crop. But for this the results on the two halves of the rotation could not have been properly compared.

On April 14, 1909, 9 pecks per acre of "Goldthorpe" barley were drilled all over the rotation, and a very nice crop was obtained which continued to be good until the bad harvesting weather of the end of August came. The plots, however, did not show any marked differences as the result of cake or corn manuring, and it was hard to judge how they were likely to turn out. The barley crop was cut September 6-7, and carted September 9; but, subsequently, very great difficulties were experienced in harvesting the crop. The threshing results are given in Table VI., p. 375.

It will be observed, in the first place, that the crops of barley were in all cases heavy, and that, taking them as a whole, they were just as good on one half of the rotation as on the other. In other words, about the same crop of barley was produced when the previous swede crop was fed off by sheep on the land as when the swede crop had been previously manured with farmyard (bullock-fed) manure. The crop was considerably heavier than that of 1908, and it certainly seemed as if a maximum had been obtained on the plots where neither cake nor corn (either as fed to sheep or as given to bullocks to make farmyard manure) had been used, as on those to which either food had been given additionally. This would account to some extent for the advantages of cake-manuring not "telling" in such a year. It is noticeable, however, that the higher nitrogenous manuring produced proportionately more straw.

When the barley was valued, the bad condition in which the crop was harvested told much upon the results. The barleys were all very indifferent, as might have been expected. This was especially the case with plot 1, in which case it was very difficult to separate the corn from the ear in

TABLE VI.—*Rotation IV. Barley*, 1909.

Stackyard Field—Produce per acre.

Plot		Head corn Weight	Head corn Bush.	Head corn Weight per bushel	Tail corn Weight	Straw, chaff, &c.	Value of corn per quarter on basis of 29s.
	UPPER HALF (Sheep-feeding).	C. q. lb.		Lb.	Lb.	C. q. lb.	s. d.
1	Swedes fed off with dec. cotton cake .	14 2 4	34·8	46·6	69	32 2 15	18 0
2	Swedes fed off with maize meal. .	18 0 14	39·5	51·4	65	32 1 5	22 0
3	Swedes fed off without cake or corn .	15 0 24	34·0	50·1	62	26 1 10	18 0
4	Swedes fed off without cake or corn .	18 2 17	40·5	51·5	58	32 2 21	21 6
	LOWER HALF (Bullock-feeding).						
5	Decorticated cotton cake dung plot .	14 3 5	32·2	51·4	50	25 1 23	22 0
6	Maize meal dung plot . . .	19 3 5	43·2	51·3	86	32 0 12	21 6
7	Dung plot without cake or corn .	18 1 7	40·6	50·4	68	29 1 25	22 0
8	Dung plot without cake or corn .	15 1 3	34·7	49·2	56	25 2 1	18 0

threshing, and this probably accounts largely for the seemingly low produce of this plot in comparison with the others, for there should be no general reason for its produce being lower than that of plot 2, especially as the straw is about the same in the two cases.

This concludes the account of the Rotation Experiments of 1909, and it is intended when, on all the rotations, a full four-years' course has been completed, to put together the results and to set out the conclusions to be drawn from them.

GREEN-MANURING EXPERIMENT (*LANSOME FIELD*), 1909.

In this season the green crops were to be grown on the different plots, and it was decided to follow them, as before, with wheat in 1910. The land was ploughed and winter tares were drilled on October 22, 1908, on plots 1 and 2, mineral manures (superphosphate and sulphate of potash) being applied at the same time to plot 1. The tares came up, but gave only

a weak plant which, with frost and snow following early in January, 1909, never looked healthy, so that on April 28, 1909, the land was drilled again with spring tares. On the same date rape seed was drilled on plots 3 and 4, and mustard seed on plots 5 and 6, mineral manures being given to plots 3 and 5. The green crops grew well and were ploughed in on June 30, a second crop of each being then grown (seed drilled July 27); this in turn was ploughed in green on September 23, wheat being subsequently sown on all the plots. Throughout the year the same differences were observed which were noted before, viz., the darker colour of the tare land and the more "open" texture of the soil as compared with that of the mustard land.

VARIETIES OF LUCERNE (*STACKYARD FIELD*), 1909.

This experiment consisted of a comparison of three different varieties of lucerne—(A) Provence, (B) American, (C) Canadian—which had been first sown in 1905 and which continued to give satisfactory crops; also of other plots sown in 1908 with seed that came direct from the Argentine. As regards these latter, it was stated in the 1908 report that the plots sown with it became without exception attacked by a fungus, *Pseudopeziza Trifolii.* On this appearing, the crops were cut down close to the ground, all stray stalks removed, and ground lime applied in the winter at the rate of 1 ton per acre. This stopped the disease, and the plant of 1909 was free from it. There was, however, so little crop that, after one cutting (August 20), the plots were given up and the land ploughed. The weights recorded, together with those of 1908, were :—

Variety	Green produce per acre						
	1908			1909			
	C.	q.	lb.	T.	c.	q.	lb.
"Chubut"	9	1	4	2	4	0	12
"Buenos Ayres" . . .	11	0	3	2	8	3	0
"La Pampa" . . .	13	3	20	1	19	1	24

Thus, of the three varieties, "Buenos Ayres" was the best, but, owing to the fungoid attack, none were really satisfactory or compared at all well with the Canadian and other varieties sown in 1905, and which remained quite free from disease although they were in close proximity to the attacked plots.

As regards these earlier sown varieties, they continued quite good and yielded three cuttings each during the year, the first on July 7, the second on August 20, and the third on November 2. The plots were cleaned early in summer; weeds and grass had begun to invade the "Provence" and "American" plots, but the "Canadian" remained much cleaner and the better crop kept the weeds down. The weights of green produce (total for three cuttings) were :—

Varieties of Lucerne (Stackyard Field).

Plot	Green produce per acre, 1909 (fourth year).				
		T.	c.	q.	lb.
A	Provence seed	10	10	2	14
B	American seed	11	8	3	0
C	Canadian seed	16	18	3	0

For the fourth successive year, accordingly, the Canadian Lucerne has yielded the largest crop, and the present appearance of this plot warrants the conclusion that it will continue to occupy the ground longer than the other two, which seem likely to be soon overrun with weeds.

INOCULATION EXPERIMENTS WITH "NITRO-BACTERINE" (*STACKYARD FIELD*), 1909.

The field experiments on inoculated lucerne and white clover, begun in 1908, were continued for a second year, although, as already stated, those with Argentine lucerne suffered much from fungoid attack, and were not continued beyond the first cutting. The white clover, however, continued quite good. It was decided to renew the inoculation with "nitro-bacterine," but, the seed having been sown the previous year, inoculation had to take the form of spreading on the plots soil which had been treated with "nitro-bacterine" preparation. This soil was spread on the "inoculated" plots on June 3, 1909. The first cutting was taken on August 20, and the weights obtained are given in Table VII., page 378.

The differences of weight shown in one plot as compared with another are the result of previous manuring, experiments on the manuring of lucerne having been carried on for a number of years previously on these same plots. As between the inoculated half and the not-inoculated half of each plot, there was, as regards the lucerne, a general agreement in showing that the inoculation, done first with the seed in 1908 and repeated in 1909 with soil top-dressing, had not been in any way beneficial. This had been the similar conclusion

TABLE VII.—*Lucerne and White Clover; seed inoculated and not inoculated.*

Green produce per acre, 1909.

	Inoculated				Not inoculated			
	T.	c.	q.	lb.	T.	c.	q.	lb.
Argentine Lucerne—Plot 1	0	5	1	16	1	6	3	24
" " " 2	0	16	0	20	2	3	0	16
" " " 3	1	1	2	8	1	6	3	24
" " " 4	0	10	3	4	0	13	1	26
" " " 5	0	18	3	14	1	8	1	7
" " " 6	2	3	0	16	2	13	3	20
" " " 7	2	3	0	16	2	19	1	8
" " " 8	3	15	2	0	5	2	1	24
" " " 9	3	15	2	0	4	11	2	20
" " " 10	2	13	3	20	2	19	1	8
Dutch White Clover	6	10	0	0	5	17	2	0
Mammoth White Clover	4	7	2	0	5	5	0	0

come to in 1908. With the white clover, however, the results were not the same, as there was a small gain with the inoculation of the Dutch White Clover, as had been the case also in 1908. With the Mammoth White Clover there was a loss by inoculation, though the 1908 experiment had not shown any.

It may be noted, in passing, that the two years' produce of the Dutch White Clover came to 7 tons 17 cwt. 2 qr. green produce per acre, that of the Mammoth White Clover to 6 tons 11 cwt. 1 qr. per acre.

EXPERIMENT ON THE USE OF LIME (*BUTT FURLONG*), 1909.

This experiment, begun in 1908, is to test the value of lime in a rotation, applied in the one case as lump lime, at the rate of 2 tons per acre, in the other as ground lime in smaller quantity, viz., 10 cwt. per acre. The crop of 1908 was barley, and the land (which is poor in lime and subject to "finger-and-toe") clearly showed the advantage of using lime, the barley crop being increased by 17 bushels per acre in the first year through the heavier application of lime. Red clover was sown among the barley, and was the crop for 1909. In November, 1908, it was quite a nice crop, but in February and March, 1909, was much damaged by frost and also by wood pigeons, which were most troublesome this season. It was cut June 10-19, but, owing to continuous bad weather, it could never be properly harvested, and practically rotted on the ground, so that it was useless to record the weights. A second application of 10 cwt. per acre of ground lime was given in the winter (1909) to plot 3, making 1 ton per acre in all since the commencement. Wheat follows in 1910.

EXPERIMENT WITH MAGNESIA ON WHEAT (*LANSOME FIELD*), 1909.

Following up experiments conducted at the Pot-culture Station, which went to show that, as the proportion of magnesia to the lime contained is increased, so the crop suffers in growth and the grain undergoes modification, it was determined to carry these out also on the field scale, and an area was set apart for the purpose in Lansome Field in 1908. Now it is obvious that, whereas in a pot-culture experiment it is easy to vary the proportion of magnesia to lime at pleasure and get results in a single season, this is not possible in a field experiment. Starting with a soil containing definite percentages of magnesia and lime (that of Lansome Field was as 1 : 2) it would need very heavy and often impracticable amounts of magnesia to be applied in order to materially alter the balance of constituents. Hence it was felt that under field conditions the experiment would have to be continued for some time. The quantities of magnesia (MgO) applied for the wheat crop of 1908 were 3 cwt. per acre and 6 cwt. per acre. The harvest results, as expected, did not show anything marked as regards difference of crop weights, but the produce of each plot was, by the kindness of Mr. A. E. Humphries, of Coxes Lock Mill, Weybridge, submitted by him to practical milling and baking tests. As these are to be continued, and will be dealt with later, it will be sufficient to say here generally that Mr. Humphries, without any previous knowledge of what each lot represented, was able to place them in order, his examination showing that as the amount of magnesia in the soil was increased, so was the inferiority of the grain, as judged by milling and baking tests, more marked. These results, confirming as they did the observations in the Pot-culture work, were considered of much importance, and so the experiments were continued in 1909. Wheat was again sown on five plots in Lansome Field on November 19, 1908, the variety grown being "Street's Imperial," obtained from Driffield, Yorks. To it superphosphate, 3 cwt. per acre, and sulphate of potash, 1 cwt. per acre, were given, and magnesia (ground fine) was top-dressed on November 26, at the rate of 1½ cwt. per acre. During the growth of the crop it was noticed that where magnesia had been applied the soil had a darker colour than the rest, and seemed to be rather more "sticky" and to remain moister. The crop was cut on August 25, 1909. The harvest results are given in Table VIII., page 380.

Examining these results it may be said that they are not very marked as regards plots 1 and 2, in comparison with plot 5, which received no magnesia, but the figures of plots 3 and 4,

TABLE VIII.—*Experiment with Magnesia on Wheat*, 1909.

Lansome Field—Produce per acre.

Plot	Applications per acre	Head corn Weight	Head corn Bush	Head corn Weight per bushel	Tail corn Weight	Straw, chaff, &c.	Value of corn per quarter on basis of 34s. 6d.
		Lb.			Lb.	C. q. lb.	s. d.
1	1908—3 cwt. magnesia, ploughed in. 1909—1½ cwt. magnesia, top-dressed.	798	13·9	57·5	132	17 2 9	34 0
2	1908—3 cwt. magnesia, after ploughing. 1909—1½ cwt. magnesia, top-dressed.	903	15·7	57·5	81	20 3 14	34 0
3	1908—6 cwt. magnesia, ploughed in. 1909—1½ cwt. magnesia, top-dressed.	732	12·9	56·5	198	16 2 20	33 6
4	1908 { 6 cwt. magnesia, after ploughing; 1½ cwt. magnesia, top-dressed.	621	10·7	58·0	195	18 1 4	32 0
5	1909—No magnesia applied . .	911	15·6	58·2	119	19 2 5	34 0

on which the larger quantity of magnesia was used, undoubtedly give an indication of the tendency of magnesia to reduce the crop. Further, it will be noted that the valuation of the corn was lower in the case of these latter plots. The wheat of plot 4 in particular was described as a "poor 'miller's wheat,' small in berry."

"POTATO-SPRAYING" EXPERIMENT (*GREAT HILL*), 1909.

On a portion of Great Hill, "Up-to-date" potatoes were grown in 1909. The "sets" were planted May 3-9, 12 tons per acre of farmyard manure having been previously applied. A good crop was obtained, and, at the close of June, by which date no "potato disease" had as yet shown itself, the most level portion of the field was put at the disposal of Mr. Spencer Pickering, of the Woburn Experimental Fruit Farm, who was desirous of carrying out some experiments with different kinds of "spraying mixtures." These experiments will be separately reported on by Mr. Pickering, but, as some of the portions were left unsprayed, and another experiment carried out here, it will be of interest to briefly record the general results obtained.

Mr. Pickering's applications consisted of: (1) the ordinary "Bordeaux mixture" (sulphate of copper and lime); (2) Woburn "Paste" (introduced by Mr. Pickering); (3) "Strawsonite." On the unsprayed portion a plot was left as it was, and, on a second portion, when disease began to appear (as happened at the end of July), the "tops" of the potatoes were cut off altogether. Disease was very prevalent throughout the crop, and though the applications were put on rather later than was desirable, the results obtained were marked ones. These are given in Table IX.

TABLE IX.—*Potato-spraying Experiments* (*Great Hill*), 1909.

Produce of Tubers per acre.

Plot	Treatment	Ware	Seed	Small	Diseased	Total produce
		T. c. q. lb.	C. q. lb.	C. q. lb.	C. q. lb.	T. c. q. lb
1	Not sprayed—tops left on.	3 5 0 17	35 1 21	22 0 23	5 1 21	6 8 0 26
2	" " tops cut off.	5 6 0 20	34 0 8	22 2 20	18 0 0	9 0 3 20
3	Sprayed with "Bordeaux Mixture"	6 7 0 23	34 3 12	7 1 13	29 2 10	9 19 0 2
4	Sprayed with "Woburn Paste"	6 1 1 18	37 0 17	8 3 6	18 0 21	9 5 2 6
5	Sprayed with "Strawsonite"	6 11 1 5	30 0 14	20 1 15	21 2 6	10 3 1 12

It will be seen, in the first place, that all the different methods of spraying produced a beneficial effect, increasing the crop largely, though the actual quantity of diseased tubers was larger than on the unsprayed plots. As between the different materials tried, the results must be left to Mr. Pickering to discuss, in view of the relative cost and trouble of application involved. It is noticeable, however, that the simple device of cutting off the tops of the plants, as soon as the leaves began to be infected with disease, had the result of considerably increasing the yield of sound tubers and of total produce. How such an increase could have taken place in view of the larger quantity of diseased tubers, is, however, hard to explain. In the case of the "sprayed" plots it may be assumed that the stopping of the ravages of the disease prolonged the growing period of the tops and hence the time of assimilation of starch in the tubers (though here again the quantity of diseased tubers was above that of the unsprayed plots), but this explanation would not hold good where the tops had been cut off. These points seem to open up interesting considerations as to what are the changes that really take place under the influence of spraying.

EXPERIMENTS WITH NITROGENOUS TOP-DRESSINGS, 1909.

In 1908 experiments with calcium cyanamide ("nitrolim") were conducted at the Woburn Farm with barley, mangolds, and potatoes. These were continued on a more extensive scale in 1909, the experiments being extended to the wheat crop; and, further, calcium nitrate was now included in the inquiry, this material having, since the earlier trial, become more generally available. The comparison was in each case made with sulphate of ammonia and nitrate of soda, a dressing of 1 cwt. per acre of sulphate of ammonia being taken as the basis, and the relative amounts of nitrate of soda, calcium cyanamide, and calcium nitrate used being arranged so that in

each case the same amount of nitrogen should be supplied. The calcium cyanamide was given mixed with dry soil, the other applications were put on unmixed.

(*a*) *Experiments with Wheat* (*Lansome Field*), 1909.

Ten plots were arranged, so as to give duplicate plots of each of the applications, viz., sulphate of ammonia, nitrate of soda, calcium nitrate, calcium cyanamide, and no top-dressing.

"Street's Imperial" wheat was drilled on November 19, 1908, 3 cwt. per acre of superphosphate and 1 cwt. per acre of sulphate of potash being given as a general mineral manuring to all plots alike. This crop followed a previous wheat crop, so that the land was in by no means "high" condition. The nitrogenous top-dressings were applied on May 19, 1909. The first manure to "show" was nitrate of soda, and this was closely followed by calcium nitrate; the influence of calcium cyanamide was next apparent, and that of sulphate of ammonia latest of all. It was difficult to say, during the growing period, which was the best crop. The wheat was cut on August 25. The results are given in Table X.

TABLE X.—*Experiments with Nitrogenous Top-dressings on Wheat*, 1909.

Lansome Field—Produce per acre.

Plot	Manures per acre	Head corn			Tail corn	Straw, chaff, &c.	Value of corn per quarter on basis of 34*s.* 6*d.*
		Weight	Bush.	Weight per bushel	Weight		
		Lb.		Lb.	Lb.	C. q. lb.	*s.* *d.*
1	Sulphate of ammonia, 1 cwt.	1,150	19·5	59·0	147	23 0 9	33 6
2	Nitrate of soda[1]	1,327	22·7	58·3	195	27 0 6	33 6
3	Calcium nitrate[1]	1,145	19·6	58·5	170	22 3 13	33 6
4	No top-dressing	675	11·2	60·0	100	15 0 12	34 6
5	Calcium cyanamide[1]	952	16·3	58·2	135	18 2 9	33 6
6	Sulphate of ammonia, 1 cwt.	782	13·5	57·7	157	19 1 15	32 0
7	Nitrate of soda[1]	950	16·6	57·2	200	19 2 9	32 0
8	Calcium nitrate[1]	742	12·9	57·5	177	20 1 8	32 0
9	Calcium cyanamide[1]	1,042	17·9	58·2	140	15 2 18	33 6
10	No top-dressing	815	13·6	60·0	57	16 2 9	34 6

[1] In quantity to supply as much nitrogen as that contained in 1 cwt. sulphate of ammonia.

The conclusions to be drawn will be stated in conjunction with the experiments on the other crops.

(*b*) *Experiments with Barley* (*Great Hill*), 1909.

In these the plan was just the same as in the wheat experiments just recorded, ten plots being marked out. In the case of the barley experiment, however, the land had been much better "done" than was the case with the wheat, inasmuch as kohl rabi had been previously fed off by sheep. "Goldthorpe" barley was drilled on April 9, 1909, and the top-dressings were applied on May 18. The crop turned out an excellent one, and, though "laid" in parts by thunderstorms, the crops were much admired, being as fine as any in the district. The crop was harvested August 30-31. The results are given in Table XI.

TABLE XI.—*Experiments with Nitrogenous Top-dressings on Barley*, 1909.

Great Hill—Produce per acre.

Plot	Manures per acre	Head corn			Tail corn	Straw, chaff, &c.	Value of corn per quarter on basis of 29*s*.
		Weight	Bush.	Weight per bushel	Weight		
		Lb.		Lb.	Lb.	C. q. lb.	*s.* *d.*
1	Calcium cyanamide[1] . . .	2,422	44·8	54·0	180	35 0 12	31 0
2	Sulphate of ammonia, 1 cwt. .	2,830	52·9	53·4	260	38 0 26	29 0
3	Calcium nitrate[1] .	2,945	55·4	53·1	222	42 1 20	29 0
4	Nitrate of soda[1] .	2,785	52·3	53·2	200	35 2 26	28 0
5	No top-dressing .	2,695	50·6	53·2	107	35 0 0	31 0
6	Calcium cyanamide[1] . . .	2,602	49·1	53·0	202	34 2 26	27 6
7	Sulphate of ammonia, 1 cwt. .	2,700	51·4	52·5	175	30 1 27	29 0
8	No top-dressing .	3,055	57·9	52·7	245	40 1 22	31 0
9	Nitrate of soda[1] .	2,600	49·2	52·8	417	38 2 5	30 0
10	Calcium nitrate[1] .	2,687	50·9	52·7	275	38 3 15	30 0

[1] In quantity to supply as much nitrogen as that contained in 1 cwt. sulphate of ammonia.

(*c*) *Experiments with Mangolds* (*Road Piece Field*), 1909.

In this series there were no duplicate plots. A "standard" dressing of manure was given to all five plots alike, consisting of:—

Farmyard manure	12 tons per acre.
Superphosphate	3 cwt. " "
Sulphate of potash	1 " " "
Salt (applied in the drills)	2 " " "

This manuring was given April 24-27, 1909, the mangold seed ("Yellow Globe") being drilled just after, and the top-

dressings were applied on July 6. The only special occurrence noticed in connection with the applications was that, owing to heavy rain just after the top-dressings had been given, the mangold leaves were beaten down, and wherever they came in direct contact with the calcium cyanamide they were scorched up and turned quite yellow, and this although the calcium cyanamide had been mixed with soil before spreading. From this injury, however, the plants quite recovered later on. The mangold crop was a splendid one for light land such as that of Road Piece, and there was not the equal of this crop in the neighbourhood. So far as the eye could judge, the calcium nitrate plot was perhaps the best. The mangolds were pulled October 25-30 and weighed. The results are given in Table XII.

TABLE XII.—*Experiments with Nitrogenous Top-dressings on Mangolds*, 1909.

Road Piece Field.

Plot	Manures per acre	Produce of roots per acre			
		T.	c.	q.	lb.
1	Standard dressing[1] with sulphate of ammonia 1 cwt.	32	2	2	0
2	„ „ „ nitrate of soda[2] . .	36	16	3	14
3	„ „ „ calcium nitrate[2] . .	40	16	3	14
4	„ „ „ calcium cyanamide[2] . .	37	5	2	14
5	„ „ only	40	15	0	0

[1] Dung 12 tons, superphosphate 3 cwt., sulphate of potash 1 cwt., salt 2 cwt. per acre

[2] In quantity to supply as much nitrogen as that contained in 1 cwt. sulphate of ammonia.

(*d*) *Experiments with Potatoes* (*Warren Field*), 1909.

Here also there were no duplicate plots, but, in place of them, were six additional plots on which magnesia in different forms was applied, and which will be dealt with under the next head. Manure to each of the plots was applied May 1-21, 1909, as follows :—

London dung	12 tons per acre.
Superphosphate	3 cwt. „ „
Sulphate of potash	1 „ „ „

"Up-to-date" potatoes were then set, and the nitrogenous top-dressings and magnesia applications were given. The crop was a very good one, but "potato disease" appeared early in August. The nitrogenous top-dressings, one and all, showed a very vigorous growth. The potatoes were dug October 9-15 and the crops weighed. The results are given in Table XIII.

TABLE XIII.—*Experiments with Nitrogenous Top-dressings, and with Magnesia, on Potatoes (Warren Field),* 1909.

Produce of Tubers per acre.

Plot	Manuring per acre	Ware				Seed & pig				Diseased			Total produce			
		T.	c.	q.	lb.	T.	c.	q.	lb.	C.	q.	lb.	T.	c.	q.	lb.
1	Standard dressing[1] only	10	13	3	0	3	3	0	14	15	1	12	14	12	0	26
	Additionally—															
2	Sulphate of ammonia, 1 cwt.	11	13	0	14	3	8	3	0	17	2	0	15	19	1	14
3	Nitrate of soda[2]	11	5	0	0	3	7	2	0	16	2	12	15	9	0	12
4	Calcium cyanamide[2]	11	4	1	14	3	6	2	12	16	1	20	15	7	1	18
5	Calcium nitrate[2]	11	15	0	0	2	17	2	0	13	3	0	15	6	1	0
6	Magnesia, 3 cwt.	10	8	0	14	2	16	1	0	13	2	18	13	18	0	4
7	Magnesia, 6 cwt.	9	8	1	21	2	8	3	0	12	3	12	12	10	0	5
8	Carbonate of magnesia, 3 cwt.	9	13	0	14	2	15	1	7	11	1	0	12	19	2	21
9	Carbonate of magnesia, 6 cwt.	9	17	3	7	2	14	1	14	13	1	16	13	5	2	9
10	Magnesian lime, 6 cwt.	9	15	0	0	2	17	0	21	14	0	7	13	6	1	0
11	„ limestone (ground), 10 cwt.	9	9	1	14	2	14	0	12	17	1	18	13	0	3	16

[1] Dung 12 tons, superphosphate 3 cwt., sulphate of potash 1 cwt. per acre.

[2] In quantity to supply as much nitrogen as that contained in 1 cwt. sulphate of ammonia.

The results in these series of experiments will now be discussed.

As regards the wheat crop in Lansome Field, it must be admitted at once that the duplicate plots are not as consistent as one would wish. It is clear, however, that the top-dressings have in all cases "told." Averaging the duplicates we have the following :—

	No top-dressing	Sulphate of ammonia	Nitrate of soda	Calcium nitrate	Calcium cyanamide
Grain—bushels per acre	12·4	16·5	19·6	16·2	17·1
Straw—cwt. per acre	15 c. 3 qr.	21 c.	23 c. 1 qr.	21 c. 2 qr.	17 c.
Gain over no top-dressing—					
Corn—bushels per acre	—	4·1	7·2	3·8	4·7
Straw—cwt. per acre	—	5 c. 1 qr.	7 c. 2 qr.	5 c. 3 qr.	1 c. 1 qr.

The best result, both in grain and straw, was thus obtained from nitrate of soda; sulphate of ammonia and calcium nitrate being practically equal in both corn and straw, while calcium cyanamide, though giving slightly more corn than sulphate of ammonia and calcium nitrate, yielded considerably less straw than either.

Passing next to the barley results on Great Hill, we are met at once with the difficulty that the produce of plots 5 and 8, on which no top-dressing was given, was the highest of the

whole series, the average of the two plots giving no less than 54·2 bushels of corn per acre, with 37 cwt. 2 qr. per acre of straw. This, for light land of this kind, is an enormous crop; it was 9 bushels more than on the highest plot of the continuous barley series, and 11 bushels more than the highest yield of the rotation series. This being so, it is clear that no deductions could be drawn from this experiment, except to show that the land, owing to the previous sheep-feeding, was amply supplied with nitrogen and needed no more; hence the extra nitrogen in the top-dressings could not "tell." Indeed, it is likely that the higher produce of plots 5 and 8 was in measure due to the fact that the crop here stood up, whereas with the heavier dressings of nitrogen it went down, and did not ripen so well. This is borne out by the valuation of the corn, which showed the highest figure in the case of plots 5 and 8. The crops, as already stated, were a credit to the farm, but were not such as could determine an experiment.

In the mangold experiment in Road Piece Field much the same happened as with the barley. Here the crops again were splendid ones, a produce of 40 tons per acre of mangolds on light sandy loam being quite exceptional. Plot 5, which had no top-dressing, gave within 2 cwt. of the highest produce, this latter being obtained with calcium nitrate. Nitrate of soda, which at one time during the period of growth seemed to be the best crop, gave the lowest yield but one, and it was clear that in a season such as that of 1909 all that the extra nitrogen supplied had done was to force on the leaf growth without increasing the bulb. Under such circumstances, as with the barley crop, no conclusions could be drawn from the experiment as regards the relative efficiency of the different nitrogenous top-dressings.

Taking, lastly, the experiment in Warren Field on potatoes. Here, too, the crops were good, but the nitrogenous top-dressings did in each case exert an influence, though not a very strongly marked one. The actually greatest increase was obtained with sulphate of ammonia, a result previously experienced on this farm. There was an increase of 1 ton 7 cwt. per acre in the total crop over plot 1 ("standard" dressing only) and of nearly 1 ton in saleable potatoes, but it is remarkable that calcium nitrate, while producing 13 cwt. less total crop per acre, gave 2 cwt. more per acre of saleable potatoes, and also less diseased tubers than on any of the other plots. Between nitrate of soda and calcium cyanamide there was nothing to choose, they both, however, falling somewhat below sulphate of ammonia and calcium nitrate.

To sum up, though, for reasons given, the experiments with barley and with mangolds did not permit of definite conclusions

being drawn, it is clear from the other two sets that there is little to choose between the four materials—sulphate of ammonia, nitrate of soda, calcium nitrate, and calcium cyanamide—so far as the efficacy of the nitrogen contained in them respectively is concerned. Certainly the differences are not always tending in the same direction, nor so regular as to warrant a distinct preference for one manure over the other, provided that the nitrogen is obtainable in each at approximately the same price per unit. On this—that is, their respective selling prices—the preference for one or the other will depend, and it remains to be seen what these prices will in the future be. An objection to calcium nitrate is its tendency to take up moisture and the consequent difficulty of keeping; on the other hand, because of the lime it contains, it will be specially useful on land poor in lime. As regards calcium cyanamide, it is the most troublesome of the four materials to handle, and will not mix well with other manures. It has a pungent smell, and the fine dust is objectionable if it blows about. It remains to be seen whether the new materials leave any residue in the land for a subsequent crop, and this is being tried with the foregoing plots in 1910.

Experiments with Magnesia on Potatoes. (*Warren Field*), 1909.

Table XIII., page 385, besides giving the results of the application of nitrogenous top-dressings to the potato crop, puts out also the results obtained from using magnesia in different forms on potatoes. The different forms used were: (1) Magnesia itself (MgO) at the rates of 3 cwt. and 6 cwt. per acre; (2) carbonate of magnesia, 3 cwt. and 6 cwt. per acre; (3) magnesian lime, 6 cwt. per acre; (4) magnesian limestone, finely ground, 10 cwt. per acre. Magnesian limestone, it may be said, is carbonate of lime and carbonate of magnesia, and the magnesian lime used was the same material after burning. The applications were given early in May, just before the "sets" were planted. The "standard" manurial dressing (dung, superphosphate, and sulphate of potash) was given in all cases alike.

During the period of growth it was noticed that plot 7 (magnesia 6 cwt. per acre) looked decidedly inferior to plot 6 (magnesia 3 cwt. per acre). An examination of the weights given in Table XIII. shows that in every case the produce of plots to which magnesia in any form had been given fell below that of the "standard" dressing only. The decrease was most marked in plot 7 (magnesia 6 cwt. per acre), and, speaking generally, the plot to which the higher quantity of magnesia, in one form or another, had been given, fell below the

corresponding one less heavily dressed. This experiment would not seem, therefore, to bear out the conclusions obtained at the farm in 1908, nor those conducted in Scotland, which indicated that carbonate of magnesia would be a useful dressing for potatoes. The matter is, however, one that requires longer and careful inquiry, and will be followed up at the Woburn farm.

RAINFALL AT WOBURN EXPERIMENTAL STATION, 1909.
(292 ft. above sea level.)

	1909 In.		1909 In.
January	0·66	July	2·88
February	0·42	August	2·30
March	2·42	September	2·26
April	1·47	October	4·05
May	1·52	November	0·71
June	3·88	December	2·62
		Total	25·19

POT-CULTURE EXPERIMENTS, 1908.

THE work at the Pot-culture Station in 1908 embraced the following :—

1. Hills' Experiments—the influence of lithium and potassium salts on wheat.
2. Green-manuring experiments.
3. Experiments on the influence of magnesia in soils.
4. Experiments with fertilisers on Fen soil.
5. Experiments with the acid soil of Plot 2*a*—continuous barley (Stackyard Field).
6. Experiments on the inoculation of leguminous crops.

1. *Hills' Experiments—the influence of Lithium and Potassium Salts on Wheat.*

In the 1907 experiments it was found that lithium salts, even when used in quantity supplying to the soil only ·0075 per cent. of the metal lithium, proved injurious. Accordingly, in 1908, the quantity of lithium was reduced by one half, viz., to ·00375 per cent. The respective salts used were the chloride, carbonate, and nitrate, and these were severally mixed with soil subsequently filled into earthenware pots, each holding about 40 lb. of soil. There were two pots in each set. Along with this experiment was a similar one with potash salts, the chloride, sulphate, carbonate, and nitrate being respectively used. These salts were given in quantity to supply the soil in each case with ·0075 per cent. of the metal potassium.

"Square Head's Master" wheat, previously dressed with hot water, was sown on November 28, 1907. The seed germinated well, in no case less than 83 per cent. of the seed coming up. The first change to be noticed was that, by the middle of March, 1908, the plants to which lithium chloride had been given assumed a very sickly look, the foliage turning very yellow. With lithium sulphate the effect was of the same kind, though not so marked, while the plants treated with lithium carbonate suffered most. Those grown with lithium nitrate had a darker colour than the rest, but did not look well. With potash salts, on the contrary, all the sets throve, and the nitrate one, though not at first looking so well, improved greatly later on and seemed to be the best of the series.

The wheat came into ear on June 23 in the case of the potash salts, and a few days later where the lithium salts were used. When the produce was weighed, the following results were obtained :—

	Corn		Straw	
	Weight	Percentage of untreated	Weight	Percentage of untreated
	Grammes	Per cent.	Grammes	Per cent.
No treatment	29·40	100·00	47·92	100·00
Lithium chloride. . .	19·37	65·90	25·16	52·50
Lithium sulphate . .	17·65	60·00	23·79	49·60
Lithium carbonate . .	14·73	50·30	19·66	41·00
Lithium nitrate . . .	21·82	74·50	31·16	65·10
No treatment	29·40	100·00	47·92	100·00
Potassium chloride . .	29·80	101·40	46·95	97·90
Potassium sulphate . .	29·10	99·01	50·08	104·50
Potassium carbonate . .	26·56	90·30	43·00	89·70
Potassium nitrate . .	31·37	106·70	48·14	100·40

From these figures it will be seen that in every case where lithium salts were used there was an injurious influence, this being most marked with the carbonate and least with the nitrate. With potash salts a tendency in this same direction was shown with the carbonate, but with none of the other salts. It is evident, therefore, that when even as little as ·00375 parts of lithium are present in 100 parts of soil, a harmful influence will be exerted on a wheat crop. The experiments will be continued with even smaller quantities of lithium.

2. *Green-manuring Experiment.*

This experiment was devised with the object of explaining the seemingly anomalous results obtained in the green-manuring experiments in Lansome Field (see page 375), where, for a number of years a better corn crop has followed the ploughing-in

of a non-leguminous crop like mustard than that obtained by ploughing in a leguminous crop like tares. Observations of the field experiments had shown that the tare soil was rendered darker in colour but looser in texture than the mustard soil, but that, though richer in organic matter and nitrogen, these were, for some reason, not rendered available for the use of the succeeding corn crop. Pot-culture experiments in 1907 had further shown that the question of water supply to the crops was a factor in the case, for, when the tare soil was liberally supplied with water, and not left, as in the field, to depend on the rainfall alone, then a better corn crop was obtained after the ploughing-in of tares than of mustard.

These considerations led to the pot-culture experiments of 1908 taking the form of seeing whether the addition of colloidal substances to the soil would have the effect of altering its physical condition and of enabling it to retain moisture better. With this object soil was taken direct from the plots in Lansome Field on which tares and mustard respectively had been grown and ploughed-in green in 1907. Silicate of alumina, silicate of soda, and kaolin were respectively added to the soil in quantity such that 100 parts of the soil contained 0·25 parts of each added material. Each experiment was in duplicate, and each pot held 34 lb. of soil, the materials being thoroughly incorporated with the whole of the soil. In addition to the use of the colloidal substances named, further trials were made with ground lime and with magnesia (MgO), for the purpose of seeing whether these substances would show any difference, on the two kinds of soil, as regards their power of breaking down the organic matter and rendering the nitrogen available for the use of the corn crop. The quantities of these used were the same as in the other cases, viz., 0·25 per cent. on the soil.

Wheat was the crop grown, and the principal differences during the period of growth were carefully noted. With silicate of alumina the results were of a most striking nature; the crops on both the tare and the mustard soil assumed a much darker colour than in any other case, indicating, seemingly, that nitrogen had been rendered available. They were far in advance of the others throughout, this being especially the case with the tare soil. Silicate of soda gave a much smaller increase, more marked with the tare soil, but in the case of the mustard soil the surface seemed to "set" hard, and this prevented free growth. Kaolin had in each case an indifferent result. The influence of lime was strikingly shown also, though not as decidedly as with silicate of alumina, and it seemed that here, too, the organic matter had been broken down and rendered available. The effect was more marked,

however, on the mustard than on the tare soil. Lastly, magnesia had a peculiar effect; on the tare soil it produced a slight increase, but a diminution with the mustard soil. The wheat came into ear on June 9, 1908, and harvesting was done on August 18. The following table gives the principal results obtained, the untreated tare soil being taken as the basis of comparison :—

	Tare Soil				Mustard soil			
	Corn		Straw		Corn		Straw	
	Weight	Percentage of untreated	Weight	Percentage of untreated	Weight	Percentage of untreared	Weight	Percentage of untreated
	Grms.	Per cent.	Grms.	Per cent.	Grms.	Per cent.	Grms.	Per cent.
No treatment . .	11·67	100	18·11	100	11·85	101	18·27	101
Silicate of alumina .	49·13	421	80·86	446	40·68	348	69·16	382
Kaolin	12·02	103	17·68	97	11·71	100	17·20	95
Silicate of soda . .	22·03	188	41·45	229	21·61	185	31·37	173
Ground lime (caustic)	24·94	213	46·32	255	31·58	270	53·06	293
Magnesia (caustic) .	17·10	146	47·80	264	5·75	49	18·74	103

Taking these figures, it is seen that the result of adding to the soil a colloidal substance like silicate of alumina resulted in a very large gain, and that this was more marked with the tare soil than the mustard.[1] Silicate of soda also gave an increase, though not so large, while kaolin had no effect. It would appear from this that the altered condition of the soil, which silicate of alumina would tend to produce, was an important element in bringing out the benefit of the previous green-manuring, as well as the superiority of the tare-manuring. This would show, accordingly, that the greater consolidation of the tare soil, and the consequent change in its physical condition (which, further, would result in moisture being retained more freely), was material to the bringing out of the value of the ploughing-in of the tare crop.

Passing to the use of lime and magnesia, it would appear that lime had in each case been effectual in breaking-down and rendering the organic matter available, but that magnesia had not produced a satisfactory result.

3. *Experiments on the influence of Magnesia in Soils.*

Previous experiments having shown that magnesia, when applied as such to the soil of Stackyard Field, produced very marked effects on the wheat crop according as the proportion of magnesia to lime in the soil was increased, it was determined to see whether this held good with regard to the insoluble forms only, and also to test what would be the effect

[1] Subsequent to the writing of the above, it has been found that the silicate of alumina used was not pure, and this may possibly necessitate some modification of the conclusions come to.

of using magnesia in the form of carbonate of magnesia and as the mineral dolomite (carbonate of lime and carbonate of magnesia) the latter of which is commercially obtainable. The soil of Stackyard Field contains ·40 per cent. of lime and ·20 per cent. of magnesia, and it had been found that, by adding magnesia (MgO) so as to bring the proportion of magnesia in the soil above that of the lime contained, the crop was increasingly diminished, the character of the roots altered, while the grain underwent an entire change from "soft" or "starchy" wheat to "hard" or "glutinous" wheat.

The materials added to the soil in this experiment were :—(1) lime and magnesia; (2) carbonate of magnesia; (3) sulphate of magnesia; (4) dolomite, finely ground; (5) lime from dolomite. The experiments were in duplicate. Wheat ("Square Head's Master") was sown on November 28, 1907, and came up well in all the sets. At first, where magnesia had been added, the crop did not seem to thrive, but it improved later; the ground dolomite set also at first looked better than the dolomite lime set, but this position was reversed later. The one set that did not look well was that where the soluble salt, sulphate of magnesia, had been used, the crop being of much lighter colour. In all cases magnesia seemed to retard the ripening, as the untreated sets were ready for harvesting on August 13, the others not until August 17. The harvest results were—

	Corn		Straw	
	Weight	Percentage of untreated	Weight	Percentage of untreated
	Grammes	Per cent.	Grammes	Per cent.
No treatment	30·54	100	52·96	100
[1]Lime and magnesia added .	41·87	137	64·81	122
[1]Carbonate of magnesia added	42·83	140	72·00	135
[1]Sulphate of magnesia added.	26·51	86	53·25	100
[1]Dolomite (finely ground) added	34·84	114	59·23	112
[1]Lime from dolomite added .	42·59	139	69·88	132

[1] The soil, after mixing, containing in each case, CaO ·80 per cent. MgO ·40 per cent.

From this experiment, taken in conjunction with others, it is clear that magnesia in the form of the sulphate (a readily soluble salt), does not act beneficially, but that in the insoluble forms magnesia may be used with advantage so long as the proportion of magnesia in the soil, subsequent to the addition, is not in excess of the lime. The results from addition of magnesia itself, of carbonate of magnesia, and of burnt dolomite (magnesian lime) were much alike, but the ground magnesian limestone (dolomite) would seem to be too slow-acting.

More striking, however, were the results produced on the grain. Whereas, on examination of this, after harvest, the wheat from the untreated and from the ground dolomite sets was found to be almost, or entirely, "starchy" in character, in every other case where there had been a marked increase in the crop the grain was decidedly glutinous. Analyses of the grain were made and gave the following percentages of nitrogen :—

	Nitrogen in grain per cent.
No treatment	1·19
Lime and magnesia	1·58
Carbonate of magnesia	1·33
Sulphate of magnesia.	1·33
Dolomite (ground)	1·22
Lime from dolomite	1·36

It will be noticed that the grain from the sets (untreated and dolomite added), which gave the least increase of crop, showed also the lowest percentage of nitrogen in the grain.

4. *Experiments with Fertilisers on Fen soil.*

The black fen soil of the Isle of Ely is very rich in nitrogenous organic matter, and, in consequence, it is unusual to use on it any nitrogenous artificial manure, lest the crop "go down." The present experiment was devised with a view of seeing whether small dressings of nitrogenous manures in conjunction with minerals would be advantageous, and also if they would bring about the better consolidation of the soil, this often being rendered too loose by the continued use of farmyard manure. It was also believed that the large stores of nitrogenous organic matter in the soil were but imperfectly utilised, through their being but slowly broken down, and it was thought possible that artificial manuring might hasten this. The following were the different treatments tried per acre :—

(*a*) No treatment.

(*b*) 4 cwt. superphosphate, 1 cwt. sulphate of potash.

(*c*) 1 cwt. sulphate of ammonia.

(*d*) Nitrate of soda = 1 cwt. sulphate of ammonia.

(*e*) 4 cwt. superphosphate, 1 cwt. sulphate of potash, 1 cwt. sulphate of ammonia.

(*f*) 4 cwt. superphosphate, 1 cwt. sulphate of potash, 1 cwt. nitrate of soda.

(*g*) 4 cwt. superphosphate, 4 cwt. kainit, 1 cwt. nitrate of soda.

(*h*) Soil mixed with ·10 per cent. magnesia (MgO).

In this experiment the mineral manures were mixed with the top layer of soil (as would be the case in practice), and the nitrogenous manures were applied as top-dressings in May, 1908.

Magnesia was mixed with the entire mass of soil used in the pot. Barley ("Malster") was sown April 3, 1908. Before the application of the top-dressing the influence of superphosphate and kainit told markedly. The crop was harvested August 15. In every case there was a gain over the untreated lots, as represented in the following table :—

	Grain per cent.	Straw per cent.
No treatment	100	100
Superphosphate and sulphate of potash . .	123	133
Sulphate of ammonia	129	113
Nitrate of soda	127	129
Superphosphate, sulphate of potash, sulphate of ammonia	159	152
Superphosphate, sulphate of potash, nitrate of soda	154	154
Superphosphate, kainit, nitrate of soda . .	177	153
Magnesium oxide	118	117

Thus, from the use of either minerals alone, or of sulphate of ammonia or nitrate of soda alone, there was a gain of from 23 per cent to 29 per cent. in corn, while, by using in conjunction superphosphate, sulphate of potash, and either sulphate of ammonia or nitrate of soda, the gain was increased to 54—59 per cent. of corn and 52-54 per cent. of straw. The substitution of kainit for sulphate of potash raised the gain to 77 per per cent. in corn, but the grain was not of such good quality. The best quality grain was obtained by using superphosphate, sulphate of potash, and sulphate of ammonia. With magnesia the gain was only small, but the quality of corn was improved.

It would seem, accordingly, that on such land as this a general manuring of mineral and nitrogenous materials would answer well, despite the richness of the soil in nitrogen.

5. *Experiments on the Acid Soil of Plot* 2.—*Continuous Barley* (*Stackyard Field*).

The object in this experiment was to see whether the acidity produced in the soil of land continuously manured with sulphate of ammonia could be removed by the application of any material, and the soil then be available for crop-growing. In 1908 the following materials were tried :—Sulphate of iron, sulphate of copper, pyrogallic acid, animal charcoal. It is not necessary to go into details of the applications, save to say that when barley was subsequently grown in the pots none of the materials used were successful in destroying the injurious effects of the acidity and producing anything like a crop, with the single exception of animal charcoal, which was given to the extent of ·10 per cent. of the soil weight. Even here it is open to question to what the action of the animal charcoal was due, and whether the lime in it may not have exerted an

influence. But it is clearly brought out that any attempt in the direction of destroying the soil acidity by the use of oxidising materials would not be successful.

6. *Experiments on the Inoculation of Leguminous Crops. ("Nitro-bacterine").*

Together with the field experiments conducted in Stackyard Field (see page 377) there were others, in 1908, carried out at the Pot-culture Station. The crops tried were (1) ordinary white clover, (2) mammoth white clover, (3) red clover, (4) lucerne. The appropriate culture material ("nitro-bacterine") for each crop was obtained direct from Professor Bottomley, and was used strictly in accordance with his directions. The seed was sown on June 16, 1908. There was little difference to be noticed between the inoculated and not-inoculated sets, but on the weighings being taken of the first cuttings, these yielded in green produce :—

	Not inoculated. Grammes	Inoculated. Grammes
Ordinary white clover	211·6	237·1
Mammoth " "	204·3	227·1
Red clover	211·0	215·6
Lucerne	76·4	72·9

There was thus a slight increase in most cases as the result of the inoculation, but this was too small to allow of any clear deductions being drawn, in view especially of the fact that the results of the field experiments tended rather in the other direction. The experiments will be repeated in 1909.

The remainder of the experimental work at the Pot-culture Station in 1908 was concerned with (1) experiments on the influence of manganese and iron sulphate on barley, (2) experiments on the influence of different grasses and clovers when sown in a corn crop, (3) further experiments on the manurial value of sewage sludge. The two former were, for various reasons, failures; and the third, which was conducted on behalf of the Royal Commission on Sewage Disposal, is fully dealt with in the Report of that Commission.

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STATISTICS AFFECTING BRITISH AGRICULTURAL INTERESTS.

As in previous years, the information compiled in the tables printed on pp. 400-405 is taken from the official publications of the Board of Agriculture and Fisheries, and the other Government Departments as follows:—Agricultural Statistics for 1909, Vol. XLIV., Part I.; Agricultural Statistics for 1908, Vol. XLIII., Parts I., II., and III.; the Preliminary Statements as to Produce of Crops, Acreage and Yield per Acre for 1909; the Annual Statements of the Board of Trade, and the Trade and Navigation Accounts for December, 1909. The data have been brought up to date by the inclusion of the figures for 1909, some of the tables having been supplied in manuscript by the Board of Agriculture and Fisheries. The Department of Agriculture and Technical Instruction for Ireland also kindly supplied tables in manuscript such as were printed in previous year's Journals, but which, owing to the reduction in the space allotted in the Journal this year, it has been found impossible to utilise in full. Their offices are at 4, Upper Merrion Street, Dublin, and they publish yearly a Report of the Proceedings under the Diseases of Animals Acts (price 4½*d.*) which gives the imports of animals between Great Britain and Ireland; Agricultural Statistics, Ireland (price 9*d.*), and the Return of Prices of Crops, Live Stock, and other Irish Agricultural Produce, all of which give useful statistical information. Those who may wish for information such as was supplied in previous volumes and which is omitted in the present one, are referred to the publications mentioned above.

Acreage of Crops.

In the first of the general tables "Acreage under Crops and Grass and number of Live Stock on June 4, 1909 and 1908," will be found a summary for the United Kingdom. In this is included the data for Ireland and the Channel Islands, for the details of which the statistics themselves must be consulted. The whole area dealt with is nearly 47,000,000 acres of crops and grass in the United Kingdom, the total having decreased by 116,000 acres since the year 1908.

We may note that in the past year, the acreage under crops and grass in Great Britain, which was nearly 32,200,000, was

less by 28,000 acres than in the previous year, and less by a quarter of a million acres than in 1900. There was, however, an increase of 108,500 acres in corn crops since the previous year.

Looking now to England alone, we find that the acreage under crops and grass diminished by 19,400 acres since the year before, but the corn crops covered an area greater than in any year since 1902, and 105,600 acres in excess of the area devoted to them in 1908. The great increase last year was in **Wheat**, which took up an additional area of 185,000 acres, an advance of nearly 12 per cent. on the total area of the previous year. There were also substantial increases in the acreage of **Beans** and **Peas**, while there was a decrease of 115,000 acres, or nearly 6 per cent., in **Oats** and a slight falling off in **Barley**.

The **Permanent Grass** increased in the same season by 11,000 acres in England. This is less than one thousandth of its area, whereas in the previous year it had increased by 93,000 acres, or more than eight times as much. There were also increases in Scotland and Wales, making the total increase in Great Britain up to 36,500 acres.

The acreage of **Potatoes** increased last year by 14,446 acres, or about one-half per cent., in England, and by 13,356 acres, or about one-third per cent., in Great Britain.

Turnips and **Swedes** showed slight increases (about one-half per cent.), both in England and in Great Britain taken as a whole. In Scotland there was a very slight decrease.

The acreage of **Mangold**, on the other hand, showed a substantial increase of 27,550 acres, or 6·6 per cent., in England. The area given to it in both Scotland and Wales is quite small.

To take a general view of the arable land as a whole, we find that corn crops occupy over 51 per cent. of the cultivated area of England and 42 per cent. of that of the United Kingdom. The area of arable land in England is 54 per cent. of the total of the United Kingdom.

Of the area under **Corn Crops** in the United Kingdom, 4,038,400 acres, or over 47 per cent., were under **Oats** which, as stated above, decreased substantially since the previous year. Taking England alone, the percentage of the corn crops area under oats was under thirty-four, and the decrease since the previous year amounted to 118,900 acres, or 6 per cent. of the area. **Wheat**, which occupied just under 25 per cent. of the acreage under corn crops in the United Kingdom, and over 31 per cent. of that in England showed an increase of no less than 185,500 acres in the year in England, where its acreage was greater than it had been since 1900, when it was 10,000 acres larger.

In the case of the other crops in England, **Barley** had practically the same acreage as the year before, **Oats** had decreased by 119,000 acres, or over 6 per cent., while there were substantial increases in **Beans** and **Peas**, and a good proportionate increase in **Rye** which, however, only takes up under 50,000 acres.

Live Stock Returns.

There was an increase this year of 12,500 **Horses**, used for agricultural purposes, which is about the same as the increase in the previous year (1908). The number of horses so used was higher than at any time within the last ten years (for which alone the statistics have been consulted), while the number of unbroken horses is less than at any time during the same period. The total number of horses used for agricultural purposes is 2,091,681 in the United Kingdom and 1,187,870 in England.

In **Cattle** there was since the previous year a total increase of 21,886 in the United Kingdom, and of 115,848 in Great Britain, while that in England alone was 101,867. There was thus a decrease of 93,962 cattle in Ireland, the Isle of Man, and the Channel Islands. There was an increase of 1,760 in Scotland, and of 12,221 in Wales.

The total number of cattle in the United Kingdom is now 11,760,678, of which 5,100,145 are in England.

The increase in the number of **Sheep** was 506,433 in the United Kingdom, while that in England was 532,937. In Scotland there was a decrease of 111,230, and in Wales an increase of 73,982. The total now stands at 31,838,833 for the United Kingdom, and 11,494,812 for England. **Pigs** decreased in the United Kingdom by 512,926, and in England by 382,803, while outside Great Britain, which we may take, practically, as Ireland, they decreased by over 70,000. The decrease in the case of the United Kingdom was about 12.6 per cent. Roughly, that is to say, that there were only six pigs where the year before there were seven.

Produce Returns.

This year the Board of Agriculture and Fisheries have most kindly supplied tables required in the actual form in which they are printed in the Journal. For this we beg to tender our best thanks. From the tables the following general conclusions may be drawn :—

The **Wheat** crop in England and Wales showed an increase in 1909 over that of the year before of no less than 1,082,295 quarters, or over 17 per cent., and amounted to 7,680,297 quarters. It was nearly 200,000 quarters better than the

crop of 1906, which was followed by two years of decreasing harvests. The produce per acre in England was 33·61 bushels, an increase of 2·22 bushels per acre over the average of the preceding ten years.

Barley also showed a great increase in 1909. The produce was 7,617,320 quarters, giving an advance of 777,265 quarters, or over 11⅓ per cent. above that of the previous year. The increase per acre was 3·79 bushels, and the average yield 36·61.

Oats, on the other hand, showed, in England, a decrease of 230,000 quarters, or just over 2·3 per cent. since 1908, and of 1,703,000 quarters since 1907. This was due to decrease of acreage, the production last year averaging 36·61 bushels per acre, as against 32·82 in 1908. In Scotland there was at the same time an increase of production. **Beans** and **Peas** both showed slight improvements of about one per cent.

Last year we recorded a great increase in the produce of **Potatoes**, but this year a diminution has to be noted, amounting in England to 2·8 per cent. (74,250 tons). The total for England was 2,643,109 tons. The loss in Scotland was 167,613 tons, or all but 16 per cent., while in Wales the decrease was under one per cent.

Turnips and **Swedes** continued to increase their yield, and last year this increase amounted to 1,355,315 tons in Great Britain, and to 2,027,212 tons in England alone. In Scotland there was a decrease of 698,355 tons. The increase in England was over 9 per cent.

Mangolds, which in England gave 9,316,314 tons, also showed a continued increase, which last year was 559,667 tons, or 6·4 per cent. This increase was due to additional acreage, as the yield per acre was a shade under that of the previous year. Scotland and Wales only produced between them rather over 250,000 tons.

The produce of **Hops** was much below that of the previous year, having fallen from 470,761 cwts. in 1908 to 214,484 cwts., or by 54·5 per cent. The acreage had decreased from 38,921 to 32,539, or by over 16 per cent., while the produce per acre fell from 12·10 cwts. to 6·59 cwts. Kent contains six-tenths of the acreage occupied by this crop, and so has most at stake. The total yield in the country was only one third of that in 1905, and was less than any in the preceding ten years at least. We must remind our readers that we only refer here to yields of produce, and that alterations of prices may have compensated many growers for the short yields.

The **Hay** harvest also showed a decrease throughout Great Britain. In England, "Hay from Permanent Grass" yielded 4,731,088 tons—less by 687,968 tons, or 12·7 per cent., than the

[Continued on page 406.]

TABLE I.—Acreage under Crops and Grass; *and* Number *of*
and Scotland, with totals for Great Britain and for the

Crops, Grass, and Live Stock.	England 1909	England 1908	Wales 1909	Wales 1908
	Acres		Acres	
Total Area (excluding water)	32,391,997		4,749,651	
Total Acreage under Crops and Grass (*a*)	24,540,985	24,560,399	2,782,479	2,787,514
Arable Land	10,628,990	10,659,477	729,122	746,709
Permanent Grass (*a*) . .	13,911,995	13,900,922	2,053,357	2,040,805
Wheat	1,734,236	1,548,732	39,583	34,573
Barley or Bere	1,379,133	1,383,326	85,272	86,693
Oats	1,839,912	1,958,810	198,528	201,595
Rye	49,254	45,842	529	951
Beans	302,653	283,661	1,376	1,116
Peas	182,209	162,023	714	753
TOTAL CORN CROPS .	5,487,397	5,382,394	326,002	325,681
Potatoes	405,529	391,083	26,994	27,330
Turnips and Swedes . . .	1,056,823	1,052,488	58,219	57,416
Mangold	442,910	415,360	11,136	10,432
Cabbage	60,404	60,489	704	717
Kohl-Rabi	17,644	17,177	71	65
Rape	75,978	74,303	4,690	4,642
Vetches or Tares	127,415	117,502	601	618
Lucerne	64,908	64,760	385	368
Hops	32,539	38,921	—	—
Small Fruit	78,124	75,750	1,198	1,200
Clover, Sainfoin, and Grasses under Rotation . . .	2,383,459	2,556,508	292,636	311,387
Other Crops	119,349	111,532	1,110	1,072
Bare Fallow	276,511	301,210	5,376	5,781
	No.	No.	No.	No.
Horses used for Agricultural purposes (*b*)	879,212	866,709	96,795	96,827
Unbroken Horses — One year and above	218,234	222,179	41,790	42,285
Unbroken Horses — Under one year	90,424	91,014	22,048	22,150
TOTAL OF HORSES .	1,187,870	1,179,902	160,633	161,262
Cows and Heifers — In milk . . .	1,624,779	1,592,919	241,907	240,160
Cows and Heifers — In calf but not in milk . . .	448,661	453,593	43,719	45,225
Other Cattle:—Two years and above	989,723	1,039,191	82,645	84,646
" " One year and under two	1,018,930	966,303	181,264	173,179
" " Under one year	1,018,052	946,272	195,137	180,241
TOTAL OF CATTLE .	5,100,145	4,998,278	744,672	732,451
Ewes kept for Breeding . .	6,191,525	5,980,125	1,582,187	1,545,507
Other Sheep:—One year and above . .	3,585,604	3,366,497	831,761	817,245
" " Under one year	6,717,683	6,612,253	1,381,394	1,358,608
TOTAL OF SHEEP	16,494,812	15,958,875	3,795,342	3,721,360
Sows kept for Breeding . .	268,401	315,524	32,857	37,510
Other Pigs	1,777,883	2,123,563	171,927	203,101
TOTAL OF PIGS .	2,046,284	2,439,087	204,784	240,611

(*a*) Not including Mountain and Heath Land.
(*b*) Including Mares kept for Breeding.

Live Stock, *on June* 4, 1909 *and* 1908, *in England, Wales, United Kingdom.*

Scotland		Great Britain		United Kingdom, including Ireland, Isle of Man, and the Channel Islands	
1909	1908	1909	1908	1909	1908
Acres 19,070,182		Acres 56,211,830		Acres 76,644,480 (*c*)	
4,859,609	4,863,473	32,183,073	32,211,386	46,885,810	47,001,961
3,372,556	3,389,331	14,730,668	14,795,517	19,457,566	19,478,399
1,487,053	1,474,142	17,452,405	17,415,869	27,428,244	27,523,562
49,679	43,428	1,823,498	1,626,733	1,868,385	1,664,860
199,981	197,418	1,664,386	1,667,437	1,829,933	1,824,410
943,437	948,513	2,981,877	3,108,918	4,038,425	4,189,378
5,783	5,951	55,566	52,744	63,149	60,962
9,835	10,247	313,864	295,024	315,608	296,918
987	963	183,910	163,739	184,297	164,183
1,209,702	1,206,520	7,023,101	6,914,595	8,299,797	8,200,711
142,938	143,692	575,461	562,105	1,167,084	1,161,122
440,506	440,993	1,555,548	1,550,897	1,840,602	1,837,997
2,444	1,980	456,490	427,772	530,930	500,782
5,746	7,914	66,854	69,120		
19	10	17,734	17,252	215,064	215,674
6,775	7,550	87,443	86,495		
8,229	7,963	136,245	126,083	138,386	128,276
34	28	65,327	65,156	—	—
—	—	32,539	38,921	32,539	8,9 2
7,794	7,930	87,116	84,880	(*d*) 100,181	(*d*) 97,570
1,538,480	1,553,692	4,214,575	4,421,587	6,587,772	6,725,921
2,635	2,798	123,094	115,402	255,826	255,962
7,254	8,261	289,141	315,252	289,385	315,462
No.	No.	No.	No.	No.	No.
156,007	155,788	1,132,014	1,119,324	1,512,175	1,501,569
34,633	35,345	294,657	299,809	394,333	398,780
13,850	13,374	126,322	126,538	185,173	188,364
204,490	204,507	1,552,993	1,545,671	2,091,681	2,088,713
365,532	364,684	2,232,218	2,197,763	4,360,620	4,368,365
69,578	67,199	561,958	566,017		
244,847	247,851	1,317,215	1,371,688	2,346,265	2,417,725
273,724	276,001	1,473,918	1,415,483	2,518,485	2,475,275
222,484	218,670	1,435,673	1,354,183	2,535,308	2,477,427
1,176,165	1,174,405	7,020,982	6,905,134	11,760,678	11,738,792
3,036,764	3,043,457	10,810,476	10,569,089	12,485,137	12,241,317
1,443,542	1,449,025	5,860,907	5,632,767	6,668,618	6,399,167
2,847,959	2,947,013	10,947,036	10,917,874	12,685,078	12,691,916
7,328,265	7,439,495	27,618,419	27,119,730	31,838,833	31,332,400
15,294	16,442	316,552	369,476	438,885	495,305
114,525	127,342	2,064,335	2,454,006	3,103,982	3,560,488
129,819	143,784	2,380,887	2,823,482	3,542,867	4,055,793

(*c*) Figures for Jersey include Water.
(*d*) Figures for Ireland include Orchards.

TABLE II.—**Produce of Crops**—*Estimated* **Total Produce and Yield per Acre** *of the undermentioned* **Crops** *in Great Britain in the Year* **1909**, *with Comparisons for* 1908, *and the Average Yield per Acre of the Ten Years* 1899-1908.

Crops		Estimated total produce		Acreage		Average estimated yield per acre		Average of the ten years
		1909	**1908**	**1909**	**1908**	**1909**	**1908**	**1899-1908**
		Qrs.	Qrs.	Acres	Acres	Bush.	Bush.	Bush.
Wheat	England	7,285,506	6,225,181	1,734,236	1,548,732	33·61	32·16	31·39
	Wales	138,980	117,010	39,575	34,573	28·09	27·08	26·39
	Scotland	255,811	224,701	49,679	43,428	41·19	41·39	38·86
	Great Britain	7,680,297	6,566,892	1,823,490	1,626,733	33·69	32·29	31·46
Barley	England	6,340,580	5,617,155	1,379,133	1,383,326	36·78	32·48	32·91
	Wales	339,839	324,945	85,272	86,693	31·88	29·99	31·09
	Scotland	936,901	8 97,955	199,981	197,418	37·48	36·39	35·32
	Great Britain	7,617,320	6,840,055	1,664,386	1,667,437	36·61	32·82	33·09
Oats	England	9,763,873	9,993,773	1,839,912	1,958,736	42·45	40·82	41·75
	Wales	876,457	864,420	198,528	201,595	35·32	34·30	34·48
	Scotland	4,737,867	4,595,211	943,437	948,513	40·18	38·76	36·60
	Great Britain	15,378,197	15,453,404	2,981,877	3,108,844	41·26	39·77	39·65
Beans	England	1,070,238	1,057,467	301,287	282,573	28·42	29·94	29·77
	Wales	4,531	3,714	1,347	1,083	26·91	27·43	26·56
	Scotland	42,411	44,261	9,172	9,572	36·99	36·99	34·78
	Great Britain	1,117,180	1,105,442	311,806	293,228	28·66	30·16	29·97
Peas	England	546,064	540,404	168,673	153,086	25·90	28·24	27·39
	Wales	1,934	2,094	708	746	21·86	22·46	21·53
	Scotland	2,119	2,035	602	566	28·15	28·76	26·67
	Great Britain	550,117	544,533	169,983	154,398	25·89	28·21	27·35
		Tons	Tons			Tons	Tons	Tons
Potatoes	England	2,643,109	2,717,539	405,529	391,083	6·52	6·95	5·83
	Wales	150,398	151,700	26,994	27,330	5·57	5·55	4·98
	Scotland	880,946	1,048,559	142,938	143,692	6·16	7·30	6·09
	Great Britain	3,674,453	3,917,618	575,461	562,105	6·39	6·97	5·85
Turnips and Swedes	England	16,543,107	14,515,895	1,056,823	1,052,488	15·65	13·79	12·57
	Wales	959,767	933,309	58,219	57,416	16·49	16·26	14·88
	Scotland	7,620,676	8,319,031	440,506	440,993	17·30	18·86	15·55
	Great Britain	25,123,550	23,768,235	1,555,548	1,550,897	16·15	15·33	13·49
Mangold	England	9,316,314	8,756,647	442,910	415,360	21·03	21·08	19·70
	Wales	211,382	196,117	11,136	10,432	18·98	18·80	17·40
	Scotland	42,908	42,503	2,444	1,980	17·56	21·47	17·67
	Great Britain	9,570,604	8,995,267	456,490	427,772	20·97	21·03	19·62
						Cwt.	Cwt.	Cwt.
Hay from Clover, Sainfoin, &c.	England	2,690,595	2,597,094	1,449,286	1,626,832	28·85	31·93	29·64
	Wales	192,907	228,448	170,497	178,537	22·63	25·59	24·92
	Scotland	652,589	681,242	415,990	426,984	31·38	31·91	32·30
	Great Britain	2,936,091	3,506,784	2,035,773	2,232,353	28·84	31·42	29·73
Hay from Permanent Grass	England	4,731,088	5,419,056	4,094,162	4,267,562	23·11	25·40	24·12
	Wales	484,687	559,627	529,567	520,098	18·31	21·15	19·46
	Scotland	216,585	234,672	152,965	152,290	28·32	30·82	29·72
	Great Britain	5,432,360	6,213,355	4,776,694	4,948,950	22·75	25·11	23·80

TABLE III.—*Estimated Total Production of* Hops *in the Years 1909 and 1908, with the Acreage and Estimated Average Yield per Statute Acre, in each County of England in which Hops were grown.*

Counties	Estimated total produce		Acreage returned on 4th June		Estimated average yield per acre[1]	
	1909	1908	1909	1908	1909	1908
	Cwt.	Cwt.	Acres	Acres	Cwt.	Cwt.
Kent — East	34,861	84,469	5,711	7,364	6·10	11·47
Kent — Mid.	58,283	118,003	6,724	7,900	8·67	14·94
Kent — Weald	62,600	108,843	7,201	8,711	8·69	12·49
Total, Kent	155,744	311,315	19,636	23,975	7·93	12·98
Hants	9,444	21,176	1,414	1,636	6·68	12·94
Hereford	14,966	54,554	4,997	5,572	2·99	9·79
Surrey	2,344	8,021	544	648	4·31	12·38
Sussex	15,785	40,203	2,775	3,579	5·69	11·23
Worcester	16,123	34,256	3,054	3,353	5·28	10·22
Other Counties[2]	78	1,236	119	158	0·66	7·82
Total	214,484	470,761	32,539	38,921	6·59	12·10

[1] The average yield per acre is calculated on the acreage returned on 4th June, but as a certain proportion of that acreage was not picked, the yield per acre on the acreage actually picked would be rather higher.

[2] Gloucester and Salop.

TABLE IV.—*Quantities and Values of* Corn *Imported into the United Kingdom in the undernoted Years.*

Description	Quantities			Values		
	1907	1908	1909	1907	1908	1909
	Cwt.	Cwt.	Cwt.	£	£	£
Wheat	97,168,000	91,132,705	97,854,825	37,346,830	38,295,940	45,286,798
Wheat meal and flour	13,297,357	12,969,855	11,052,540	6,694,532	7,075,231	6,370,488
Barley	19,628,620	18,137,200	21,556,470	6,565,006	6,113,945	7,143,849
Oats	10,488,290	14,271,150	17,840,498	3,384,577	4,162,775	5,439,484
Peas	1,245,670	1,060,999	1,314,149	602,648	538,315	603,054
Beans	799,569	1,043,097	2,171,230	290,693	373,018	757,600
Maize	53,378,950	33,841,000	39,362,605	14,604,159	10,388,061	12,122,272
Oatmeal and groats	638,702	500,698	583,125	479,352	416,134	465,118
Maize meal	658,656	450,410	334,140	213,581	159,484	127,751
Other kinds of corn and meal	1,588,958	1,618,180	1,626,296	644,789	682,289	677,547

TABLE V.—*Average* Prices *of* British Corn *per Imperial Quarter in England and Wales, as ascertained under the Corn Returns Act*, 1882, *in each Week of the Year* 1909.

Week ended	Wheat	Barley	Oats	Week ended	Wheat	Barley	Oats
	s. d.	*s. d.*	*s. d.*		*s. d.*	*s. d.*	*s. d.*
January 2	32 0	26 7	17 4	July 3	42 9	27 2	21 9
January 9	32 9	26 11	17 5	July 10	43 0	26 4	21 8
January 16	32 8	27 1	17 5	July 17	43 3	26 10	21 9
January 23	33 2	27 3	17 8	July 24	44 0	27 4	22 5
January 30	33 0	27 6	17 9	July 31	43 5	24 6	22 2
February 6	33 4	27 7	17 10	August 7	44 9	27 4	22 11
February 13	33 8	27 8	17 11	August 14	44 9	24 9	21 8
February 20	34 1	27 11	18 0	August 21	41 6	23 11	19 8
February 27	34 5	28 0	18 0	August 28	38 5	24 7	19 4
March 6	34 10	27 11	18 2	September 4	37 2	26 3	19 6
March 13	35 8	28 4	18 2	September 11	34 11	26 1	18 5
March 20	35 9	28 0	18 5	September 18	33 6	26 5	17 9
March 27	36 0	28 0	18 6	September 25	32 9	26 8	17 7
April 3	36 5	27 10	18 8	October 2	32 2	26 9	17 2
April 10	37 4	28 0	18 10	October 9	31 8	26 9	17 0
April 17	38 7	27 8	19 2	October 16	31 4	27 0	17 0
April 24	41 4	28 2	19 9	October 23	31 8	27 7	16 11
May 1	42 5	27 10	20 0	October 30	31 10	27 9	17 0
May 8	40 9	27 7	20 3	November 6	32 5	27 9	17 0
May 15	41 6	27 3	20 6	November 13	32 5	27 7	17 1
May 22	42 8	27 0	20 11	November 20	32 7	27 0	17 4
May 29	42 6	26 3	21 0	November 27	33 0	26 8	17 3
June 5	43 1	25 7	21 3	December 4	33 3	26 1	17 4
June 12	42 11	26 10	21 4	December 11	33 3	25 7	17 3
June 19	42 7	26 10	21 6	December 18	33 2	25 3	17 4
June 26	42 8	27 2	21 7	December 25	33 1	25 2	17 4
				Average of year	36 11	26 10	18 11

TABLE VI.—*Annual Average Prices per Quarter and total Quantities of* British Corn *sold in the Towns in England and Wales making Returns under the Corn Returns Act*, 1882, *in the Year* 1909.

Year	Wheat	Barley	Oats	Wheat	Barley	Oats
	s. d.	*s. d.*	*s. d.*	Qrs.	Qrs.	Qrs.
1909	36 11	26 10	18 11	2,641,225	2,699,628	905,983

TABLE VII.—*Annual and Septennial Average Prices per Bushel of* British Corn *in the Year* 1909, *with the Value of* 100*l.* *of Tithe Rent-charge.*

Year	Annual average price			Septennial average price			Value of tithe rent-charge of 100*l.*	
	Wheat	Barley	Oats	Wheat	Barley	Oats	Calculated on annual average	Calculated on septennial average
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	£ *s. d.*	£ *s. d.*
1909	4 $7\frac{1}{4}$	3 $4\frac{1}{4}$	2 $4\frac{1}{4}$	3 $9\frac{1}{2}$	3 $0\frac{1}{2}$	2 $2\frac{1}{2}$	78 12 $9\frac{1}{2}$	70 7 8

TABLE VIII.—*Average* **Prices** *of* **Fat Cattle** *per cwt.* (*Live Weight*) *at the undermentioned places in England and Scotland, in each Year from* 1902 *to* 1909 *inclusive, together with the Average Prices for England, Scotland and Great Britain, compiled from the Returns received under the Markets and Fairs* (*Weighing of Cattle*) *Act,* 1891.

Places	1902	1903	1904	1905	1906	1907	1908	1909
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
ENGLAND—								
Carlisle	33 2	33 6	31 11	31 6	31 6	32 6	32 2	33 0
Leeds	35 6	34 4	33 4	32 11	33 0	33 2	33 6	33 7
Leicester . . .	35 2	33 6	32 2	32 9	31 11	32 6	33 2	34 1
Liverpool . . .	34 10	32 8	32 1	31 3	30 10	32 6	33 7	34 2
London . . .	39 4	36 4	35 6	35 4	34 10	35 9	36 8	37 7
Newcastle . . .	38 10	37 0	36 2	34 8	35 4	36 1	37 1	37 5
Shrewsbury . .	33 10	33 6	31 9	31 6	31 3	33 4	35 0	35 0
SCOTLAND—								
Aberdeen . . .	34 9	33 4	32 8	32 6	32 5	32 8	36 6	34 5
Dundee . . .	34 11	33 3	32 7	32 0	31 11	32 8	33 5	34 0
Edinburgh. . .	37 4	35 5	34 10	33 10	34 2	35 1	36 5	37 2
Glasgow . . .	37 10	36 3	35 8	32 6	32 5	33 1	34 3	34 10
Perth	37 4	35 1	33 3	34 4	34 6	35 8	37 0	37 11
England . . .	35 5	34 1	33 1	32 8	32 6	33 6	34 2	34 8
Scotland . . .	36 2	34 6	33 9	33 0	33 0	33 9	34 8	35 6
Great Britain . .	35 11	34 4	33 7	32 11	32 11	33 8	34 7	35 4

TABLE IX.—*Average* **Prices** *of* **Wool** *in each Year from* 1889 *to* 1909 *inclusive.*

Year	BRITISH				AUSTRALIAN[3]	NEW ZEALAND[3]	SOUTH AFRICAN[3]
	Leicester[1]	Half-breds[1]	Southdown[1]	Lincoln[2]			
	Per lb.	Per lb.	Per lb.	Per lb.	Per lb.	Per lb.	Per lb.
	d. d.	*d. d.*	*d. d.*	*d.*	*d.*	*d.*	*d.*
1889	9¾ to 10½	10¼ to 11	10¼ to 12½	11	10⅜	10¼	10⅜
1890	10 ,, 10½	10¾ ,, 11½	11 ,, 13	11	11	10¾	10⅜
1891	9½ ,, 10	10 ,, 10¾	10½ ,, 13	9¾	9¾	9¾	9¾
1892	8½ ,, 9	9¾ ,, 10¼	10½ ,, 12½	8¾	8⅞	9¼	9⅜
1893	8½ ,, 9¼	9½ ,, 10¼	10½ ,, 12	10¼	8¾	9⅛	9¼
1894	9 ,, 10	9½ ,, 10¾	9¾ ,, 12	10⅛	8½	9	9⅜
1895	9½ ,, 10½	9¼ ,, 11	9½ ,, 11½	12	8	8½	9¼
1896	9¾ ,, 11	9¼ ,, 10¾	9¼ ,, 11¼	11½	8½	8⅜	7⅝
1897	8¾ ,, 10	8¾ ,, 9¾	8¾ ,, 10½	9⅝	8	8⅝	7½
1898	8 ,, 8¾	7¾ ,, 8¾	8¼ ,, 9¾	8¾	8⅝	8⅜	7⅝
1899	7 ,, 8	7 ,, 8¼	7¾ ,, 11	8¼	9⅜	8	7⅞
1900	6¼ ,, 7½	6¾ ,, 8¾	8 ,, 12	7⅞	11	8½	8⅜
1901	5½ ,, 6	5½ ,, 9¼	7¼ ,, 9¼	6⅞	8¼	6⅝	7
1902	5 ,, 5⅝	5⅜ ,, 6⅞	7⅛ ,, 9⅛	6¼	8⅝	6⅛	7⅜
1903	6½ ,, 6⅞	7⅛ ,, 8	8½ ,, 11½	7¼	9⅞	7⅜	7½
1904	8⅞ ,, 9⅝	9½ ,, 10⅛	9½ ,, 11¾	10½	10	8½	7⅝
1905	11⅜ ,, 12	11⅝ ,, 12¾	11⅞ ,, 13¼	12½	10¼	9¾	7⅝
1906	12⅝ ,, 13	13⅜ ,, 14⅛	14⅛ ,, 15⅛	14⅛	11	11⅜	8⅛
1907	12⅜ ,, 12⅞	12⅞ ,, 13⅞	13⅞ ,, 15	12¼	10⅞	11⅝	8⅝
1908	8½ ,, 8⅞	8¾ ,, 10	11½ ,, 12½	8¼	10	8⅞	8⅝
1909	8⅛ ,, 8⅝	10 ,, 11⅞	12¼ ,, 13⅜	8¾	10½	9⅜	8¾

1 Computed from the prices given in *The Economist* newspaper.
2 Extracted from "*The Yorkshire Daily Observer* Wool Tables."
3 Computed from the *Annual Statement of Trade and Navigation.*

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year before. The yield per acre fell from 31·93 cwts. to 28·85 cwts., while the acreage decreased by 1,173,400 acres from the year before to 5,432,360 acres, which means a fall of 21·6 per cent. In Wales the percentage of decrease was 13·4, and in Scotland 4·2. Throughout Great Britain the yield was below the average of the preceding ten years by about 4 per cent. "Hay from Clover, Sainfoin, etc.," also showed a general reduction in quantity, having fallen in England from 2,597,094 tons in 1908 to 2,090,595 tons in 1909. This is a decrease of 19·5 per cent. The acreage meantime decreased by 177,546 acres, or nearly 11 per cent., while the yield per acre fell from 31·93 cwts. to 28·85 cwts. The average yield per acre for the preceding ten years was 29·64. In Wales also this class of hay was deficient in quantity, while Scotland produced very nearly as much as in the preceding year, and more than its average.

THE WEATHER OF THE PAST AGRICULTURAL YEAR.

As a result of an inquiry conducted some few years ago by Dr. W. N. Shaw, the Director of the Meteorological Office, it appeared that in spite of any adverse influences in the following seasons a dry autumn is succeeded almost invariably by a yield of wheat in excess of the average. The accuracy of the proposition appears to have been confirmed to a large extent by the agricultural experiences of last year. In the autumn of 1908 there was a considerable deficiency of rain in nearly all parts of the country. The season was followed by a changeable winter and early spring, with occasional touches of severe frost. The later spring months were characterised by much brilliant weather, but after May, and with the exception of an exceedingly fine fortnight in the early part of August, the weather of the summer was almost continuously cloudy and cool. In spite of this the crops appear to have ripened well, and until the commencement of the harvest they presented an unusually flourishing appearance. Much damage was afterwards occasioned by frequent heavy rains, which also caused serious delay in reaping operations. Notwithstanding all these adverse influences the yield of most of the cereals was either equal to or slightly above the average, a result which caused no little surprise to the ordinary individual who, smarting under a recollection of spoilt holidays, regarded the summer as one of the worst within living memory. The autumn of 1909 was less propitious than its predecessor, an abundance of rain keeping the ground in a soddened state, and interfering greatly with all

farm work, so that the opening of the present agricultural season could scarcely be regarded as favourable.

THE WINTER OF 1908-9.

The winter opened with a long spell of mild south-westerly breezes and changeable, showery weather, broken on the 10th and 11th December by a rather severe gale from west and north-west, with heavy rain in Scotland. Until Christmas time no frosts of any consequence were reported, and on some occasions the mid-day temperatures were unusually high for the time of year, readings above 55° being reported in the south of Ireland and the south-west of England on the 13th, and again, sporadically, between the 19th and 21st. On Christmas morning, however, the wind began to back to the south-eastward, and in the course of the next few days a stream of very cold air swept over the United Kingdom from the Continent, while heavy snowstorms set in over nearly the whole country. The sharpest frosts were experienced on the 29th or 30th, when the sheltered thermometer fell below 10° in many parts of central and southern England, zero being touched at Maidenhead, and passed by 1° at Liphook (Hants). On the surface of the snow-covered ground readings below zero were fairly common, the exposed thermometer at Epsom falling 8° below that level.

The frost was, however, of short duration. On the night of December 30, a mild breeze from south and south-west extended over the whole kingdom, and temperature rose rapidly, no further frosts of any severity being experienced until very nearly the middle of January, and then only in Scotland. During the first week in the new year the wind was generally light and variable, and the weather cloudy but fairly mild, but on the 7th and 8th a cold breeze from north and north-west was accompanied by showers of snow in many eastern and central districts. After that a strong current from south-west and west set in (reaching the force of a gale on the 13th and 14th), but in the latter half of the month the wind was chiefly from some southerly quarter, and the weather dry and cold, with thick inland fogs on the 27th and 28th. The sharpest January frosts occurred between the 25th and 30th, when the sheltered thermometer sank below 15° at many central stations in England and Wales. On the grass the readings were naturally still lower, the exposed thermometer falling to 10° at Harrogate and 2° at Llangammarch Wells, in Central Wales.

In the early part of February the winds varied a good deal in direction and the weather was rather changeable, with heavy rains in the north-west of England between the 2nd and 4th. Towards the middle of the month the wind became easterly

and north-easterly, with cold weather, and snow in most districts, a sharp frost occurring very generally on the nights of the 13th and 14th. In the closing week variable airs and fair dry weather prevailed, with severe frost between the 23rd and 25th, when the thermometer fell below 15° in many parts of central and southern England, and reached 7° at Wokingham. The sharpest weather of the whole season occurred, however, at a time when winter should, in the ordinary way, have been giving place to spring. In the first week in March frosts and snowstorms of great intensity were experienced over the country generally, the sheltered thermometer sinking below 10° in many parts of Great Britain, and reaching zero at Marlborough. At Llangammarch Wells, on the grass, a reading of 4° below zero was recorded both on the 4th and 5th.

For the winter as a whole the mean temperature was below the average and the rainfall generally deficient. In the east and north-east of England only three-fourths of the normal quantity was collected, and in the midland and south-western counties less than three-fourths. Considerably more than the average amount of bright sunshine was recorded in the western and southern districts, but in other parts of the country the conditions in this respect were about normal.

The Spring of 1909.

The wintry weather which set in at the beginning of March continued in a gradually modified degree until after the middle of the month, the wind being generally from points between north and east, with frequent showers of snow or sleet in nearly all parts of the country. After about the 6th, however, no very sharp frosts were experienced until the nights of the 15th and 16th, when the thermometer again fell to a low level for the time of year. In the screen the readings recorded at this time were below 20°, the thermometer at Wokingham falling to 8°; while on the surface of the grass a reading as low as 3° was registered at Llangammarch Wells. After about the 17th the wind got round to the southward, and for the remainder of March the weather, though generally cloudy and unsettled, was fairly mild. No sign of genial spring warmth was, however, perceptible until the 29th, and then only in the east and south-east of England, where the thermometer rose slightly above 60°.

Early in April a large anticyclone, or area of high barometrical pressure, extended over the United Kingdom from the Continent, and for some eight or nine days brilliantly fine weather prevailed very generally, the week ending the 10th being one of the sunniest on record. At many places in the east and south-east of England the sun shone for more

than 90 per cent. of the time it was above the horizon, and, in response, the thermometer rose steadily to a springlike level, the maximum shade readings of the 9th to 11th being slightly above 70° in many parts of England, and as high as 74° at Maidenhead and Cullompton (Mid Devon). The anticyclone was then passing away to the south-westward, and for the remainder of April the weather was influenced by cyclonic areas which came in from the Atlantic. Rain was therefore frequent (during a thunderstorm on the 23rd nearly an inch fell on the coasts of Kent), but substantial intervals of bright weather were experienced, and, with winds mostly from some southerly quarter, the temperature was for some time above the average. Quite at the close of the month, however, a cold breeze spread down from the northward, and on the 29th and 30th showers of hail or snow, accompanied in some places by thunder, were reported in many districts

May opened with a spell of weather strikingly similar to that experienced early in April. Under the influence of a large anticyclone which drifted slowly north-eastwards across western Europe the sky again became almost cloudless, and in the week ending the 8th more than 90 per cent. of the possible amount of bright sunshine was experienced over central and southern England. With winds mainly from some easterly point the thermometer, however, failed to rise to any very high level, shade readings above 70° being recorded only in a few scattered places. In the second week the wind shifted to the northward, and the weather became cold and changeable, snow showers occurring on the 13th as far south as London and Rothamsted, with sharp night frosts between the 13th and 15th. Later on fine bright weather set in very generally over England, but in the closing week the advance of cyclonic areas from the Atlantic was marked by rather frequent rains, with, however, a general rise of temperature. Between the 21st and 23rd shade readings of 80° and upwards were recorded in several parts of England, the thermometer touching 84° at Maidenhead on the 21st, and at Greenwich on the 22nd.

For the spring as a whole the mean temperature was rather above the average, and rainfall also in excess, the wettest weather being experienced over our southern counties and in the north-east of England. Bright sunshine was abundant, the duration amounting on an average to more than one hour per day in excess of the normal in the eastern, midland, and north-western counties, and to about an hour and a half per day more than the normal in the south-east of England. At Westminster the total amount of sunshine both in March and April was the largest observed in those months since the recording instrument was started in 1883.

Rainfall, Temperature, *and* **Bright Sunshine** *experienced over* **England** *and* **Wales** *during the whole of* **1909,** *with Average and Extreme Values for Previous Years.*

Districts	Rainfall							
	Total Fall				No. of Days with Rain			
	In 1909	For 43 years, 1866-1908			In 1909	For 28 years, 1881-1908		
		Average	Extremes			Average	Extremes	
			Driest	Wettest			Driest	Wettest
	In.	In.	In.	In.				
North-eastern	27·3	25·6	19·9 (1884)	37·2 (1872)	193	186	162 (1884)	208 (1894)
Eastern	26·0	24·8	19·1 (1874 and 1887)	33·1 (1872)	201	179	156 (1898)	205 (1894)
Midland	27·9	27·6	19·2 (1887)	39·8 (1872)	191	179	148 (1887)	210 (1882)
South-eastern	32·1	28·7	21·5 (1887)	41·7 (1872)	186	173	137 (1899)	197 (1882 and 1903)
North-western with North Wales	37·9	37·8	24·9 (1887)	59·2 (1872)	203	200	163 (1887)	226 (1903)
South-western with South Wales	37·5	41·7	28·3 (1887)	68·6 (1872)	201	199	159 (1887)	235 (1882)
Channel Islands[1]	30·4	32·1	26·2 (1887)	39·5 (1882)	191	210	169 (1899)	251 (1886)

Districts	Mean Temperature				Hours of Bright Sunshine			
	In 1909	For 43 years, 1866-1908			In 1909	For 28 years, 1881-1908		
		Average	Extremes			Average	Extremes	
			Coldest	Warmest			Cloudiest	Sunniest
	°	°	°	°				
North-eastern	46·7	47·5	44·8 (1879)	49·0 (1898)	1403	1330	1006 (1885)	1601 (1906)
Eastern	47·7	48·5	45·6 (1879)	49·8 (1868)	1619	1586	1267 (1888)	1864 (1899)
Midland	47·0	48·4	45·6 (1879)	51·1 (1868)	1450	1407	1173 (1888)	1715 (1893)
South-eastern	48·3	49·6	46·7 (1879)	51·4 (1898)	1743	1613	1245 (1888)	1983 (1899)
North-western with North Wales	47·1	48·5	45·7 (1879)	50·3 (1868)	1514	1393	1198 (1888)	1683 (1901)
South-western with South Wales	48·5	50·1	48·1 (1888)	52·8 (1868)	1699	1646	1459 (1888)	1964 (1893)
Channel Islands[1]	51·6	52·2	50·5 (1885)	54·1 (1899)	1975	1896	1710 (1888)	2300 (1893)

NOTE.—The above Table is compiled from information given in the Weekly Weather Report of the Meteorological Office.

[1] For the Channel Islands the "Averages" and "Extremes" of Rainfall and Mean Temperature are for the twenty-eight years, 1881-1908.

The Rainfall of 1909 *and of the previous Ten Years, with the Average Annual Fall for a long period, as observed at thirty-eight stations situated in various parts of the United Kingdom.*

Stations	1909 Total rain-fall	1909 Dif-fer-ence from ave-rage	Rainfall of Previous Years 1908	1907	1906	1905	1904	1903	1902	1901	1900	1899	[1] Ave-rage rain-fall
ENGLAND AND WALES:	In.	Per cent.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Durham	24·8	— 9	19·4	24·8	23·8	19·2	19·0	30·8	18·5	22·9	28·8	24·5	27·2
York	24·8	— 2	21·8	25·6	22·8	20·7	20·8	30·3	18·7	20·5	25·8	22·4	25·3
Hillington	33·6	+22	25·5	25·7	31·6	22·7	25·7	35·6	26·2	24·4	32·6	24·7	27·5
Yarmouth	24·2	— 4	22·5	21·9	28·0	22·6	21·0	25·1	21·4	21·2	24·7	22·4	25·3
Cambridge	23·1	+ 2	17·6	21·2	22·4	19·0	17·6	30·5	15·8	16·7	19·7	19·3	22·7
Rothamsted	26·8	— 4	23·4	25·3	26·8	24·8	23·2	36·3	19·6	21·1	27·1	25·1	27·9
Nottingham	25·2	+ 2	21·3	23·5	21·8	18·6	20·0	32·2	21·5	20·4	28·5	22·6	24·8
Cheadle	37·7	+15	33·3	31·9	34·3	26·7	26·3	39·2	26·4	27·7	37·5	30·9	32·8
Hereford	24·0	—11	23·9	29·7	23·6	24·0	25·0	37·8	24·3	25·2	32·8	26·7	27·0
Cirencester	32·1	+ 5	24·5	28·9	26·2	25·1	28·8	41·1	25·1	26·1	31·0	26·8	30·7
Oxford	27·5	+1[illegible]	23·9	26·9	24·0	21·0	22·7	35·9	16·7	22·3	23·6	21·0	25·0
London	24·9	+ 2	21·3	19·5	22·2	23·0	20·2	38·0	20·4	21·5	22·2	22·0	24·4
Hastings	31·4	+ 8	22·0	23·3	28·7	26·9	24·6	32·3	23·0	19·4	29·8	25·8	2[illegible]·1
Southampton	36·1	+17	27·8	30·8	33·1	26·2	31·0	43·2	27·4	28·3	31·6	27·6	30·9
Stonyhurst	48·8	+ 4	48·3	50·0	49·7	38·8	39·6	58·9	36·8	39·0	48·3	47·5	46·8
Manchester	41·2	+11	37·7	40·4	42·2	33·3	32·0	45·2	26·5	33·3	42·8	33·5	37·0
Liverpool	28·4	— 1	28·9	26·6	28·1	24·0	25·1	34·4	25·6	25·1	31·9	27·6	28·8
Llandudno	32·0	+ 4	30·8	26·3	31·6	26·1	26·0	38·5	25·0	28·7	32·8	32·4	30·8
Pembroke	33·1	— 6	38·5	37·2	42·5	28·2	31·8	45·8	30·9	33·0	40·6	35·0	35·1
Clifton	36·8	+ 6	26·6	34·3	30·1	25·0	30·9	42·8	26·5	26·6	37·7	35·5	34·6
Cullompton	34·4	— 4	27·5	33·4	33·9	28·1	34·9	42·7	30·8	31·1	35·5	37·0	35·7
Plymouth	35·2	— 2	31·0	36·3	33·4	30·5	41·4	45·8	30·9	33·0	40·3	33·1	35·9
Scilly (St. Mary's)	27·0	—20	24·7	29·3	29·8	27·5	34·4	39·9	25·3	32·6	34·1	31·9	38·6
Jersey (St. Aubin's)	31·7	— 7	25·2	28·6	29·2	30·3	37·3	38·2	30·4	29·6	34·6	26·3	34·2
[2] Mean for the whole of England and Wales	31·3	+ 1	2· 66	29·9	29·9	25·6	28·0	37·5	26·7	27·4	32·3	28·6	31·0
SCOTLAND:													
Stornoway	46·2	— 5	52·6	43·8	42·2	50·7	55·7	62·1	46·3	42·8	62·5	59·9	48·6
Wick	33·6	+15	32·0	29·6	33·2	32·3	25·3	35·9	26·4	32·1	33·1	29·7	29·3
Aberdeen	30·4	— 1	28·0	28·7	31·5	28·5	23·7	36·3	27·3	28·0	34·0	30·3	30·7
Balmoral [3]	30·8	—14	26·2	31·8	39·1	35·6	24·9	44·1	31·8	31·4	40·5	35·6	36·0
Leith	27·1	+14	22·1	30·7	30·2	19·2	23·4	30·9	16·4	22·5	31·2	24·8	23·8
Marchmont	34·2	— 1	30·7	33·3	38·9	27·4	26·1	38·6	24·4	27·2	43·8	32·6	34·4
Fort Augustus	37·4	—16	43·9	42·0	51·6	43·6	44·4	66·0	35·6	36·9	50·5	42·3	44·6
Glasgow	39·3	+ 2	35·8	42·6	40·1	30·7	33·7	53·3	29·1	32·9	47·0	43·5	38·7
[2] Mean for the whole of Scotland	41·8	0	43·1	44·5	46·3	41·4	42·1	57·1	43·0	40·8	52·2	46·1	41·8
IRELAND:													
Belfast	35·7	+ 6	38·7	38·1	36·2	31·8	31·8	42·3	35·8	32·1	40·6	34·9	33·6
Markree Castle	40·7	— 3	47·3	45·2	44·6	30·0	44·9	54·1	38·4	44·9	45·3	43·7	42·0
Armagh	28·9	— 9	33·1	31·6	30·1	29·0	30·9	36·3	31·7	32·1	36·4	32·5	31·9
Dublin	26·9	—17	23·8	27·0	22·8	25·3	22·2	31·6	29·4	26·1	34·3	27·7	28·0
Birr Castle (Parsonstown)	29·6	—10	33·4	33·9	32·6	25·7	32·9	40·8	28·2	31·1	38·5	33·1	33·0
Kilkenny	30·1	—10	33·5	32·4	28·7	25·0	31·5	42·0	33·1	30·3	39·2	30·9	33·3
[2] Mean for the whole of Ireland	35·3	—11	39·2	39·7	36·7	34·6	38·9	47·9	37·2	37·7	44·9	40·6	39·5

[1] The Average Fall is in nearly all cases deduced from observations extending over the thirty-five years 1871–1905.
[2] The Mean Rainfall for each country is based upon observations made at a large number of stations in addition to those given above.
[3] The figures for the years prior to 1906 are for Braemar, which ceased reporting after 1906.

[Continued from page 409.]

The Summer of 1909.

The brilliant weather which prevailed so extensively in the latter half of the spring was followed by one of the dullest and coldest Junes on record. For a large portion of the month the wind was in the north, and although it seldom blew with much strength its influence was quite sufficient to keep the thermometer well below the average level, the only periods of anything like summer warmth being three short spells which occurred respectively at the beginning, around the middle, and at the end of the month. Between the 4th and 6th there were many places in which the thermometer failed to rise much above 50°—a point which is usually surpassed at some time or another in the coldest English winters. In the first fortnight very little rain fell in the more northern districts, but in the south and east the prevalence of thunderstorms between the 1st and 3rd was accompanied by heavy downpours in many places, the fall on the former date amounting to an inch and a half at Southampton, Reading, and Offley, and to rather more than an inch and a half at Maidenhead and Swarraton (Hants). In the latter half of the month thunderstorms, accompanied in many places by torrential rains were more general, the principal cases occurring between the 21st and the 24th.

In the south of England July was less cloudy than June, but over the country generally the weather was again cool, unsettled, and unusually windy, especially in the latter part of the month. Between the 17th and 21st a short burst of summer warmth was experienced, the thermometer rising above 75° in many parts of our eastern and southern counties, but at other times the maximum temperatures were often below 60°, and on the 11th several places in the north and east failed to record a reading as high as 55°. The heaviest fall of rain occurred on the 27th, when more than an inch was measured over a considerable portion of our southern counties, more than an inch and a half at Watergate (Sussex), and more than an inch and three quarters at Plymouth.

August opened with a tremendous downpour of rain in the north-east of England, amounting at Hull to nearly two inches and three quarters. On the 2nd, however, an anticyclone extended in from the westward, and in the succeeding fortnight the country enjoyed the longest, and in fact the only long, spell of fine warm weather of the whole summer. Bright sunshine was abundant, and on the 6th or 7th the thermometer in the shade rose slightly above 80° in many districts, while on the 12th it exceeded 85° over an equally wide area, and touched 90° at Maidenhead. During another burst of warmth, on the 15th readings varying between 80° and 85° were again recorded in many parts of England, and a

reading of 92° at Epsom. After this the weather again broke up completely and in the closing half of the month a gradual decline in temperature occurred, with thunderstorms and occasional heavy falls of rain in nearly all districts. On the 17th considerably more than an inch of rain was measured at a large number of stations in eastern, central, and southern England, more than two inches at Salisbury, and more than two inches and a half at Maidenhead; while on the 19th another heavy fall occurred in several isolated parts of the country.

For the summer as a whole, the mean temperature was considerably below the average in all districts, and rainfall in excess of the normal excepting in the south-western counties. In the latter region the duration of bright sunshine was in close agreement with the average but elsewhere it was rather deficient. Following a phenomenally bright April and May the amount of sunshine at Westminster in June was the smallest on record for the month since the observations commenced in 1883.

THE AUTUMN OF 1909.

After a week of changeable showery weather at the beginning of September, with severe thunderstorms on the 6th in some parts of our eastern counties, the conditions improved, and over the kingdom as a whole the succeeding fortnight was the finest and driest experienced since the middle of August. On two occasions, however, a decided break occurred locally, thunderstorms and heavy rain being experienced along the south coast of England on the 10th, and in and around the Thames Valley on the 17th. On the 2nd or 3rd of the month the thermometer rose to 70° or a little above it at several places in eastern, central, and south-eastern England, but as a rule, the wind during the fine spell blew from some northerly quarter, so that the air was decidedly cool for the time of year. After the middle of September the weather again broke up, and although the temperatures recorded during the next fortnight were equal to, or a trifle above the average, the country generally was visited by frequent thunderstorms, accompanied in many instances by very heavy falls of rain. On the 23rd and 24th amounts exceeding an inch and a half were recorded in many parts of England and Wales, the fall on the former day amounting to 1·9 in. at Belvoir Castle and to 3·4 ins. at Castle Bytham, in Lincolnshire. Almost equally large quantities were experienced in many western and southern districts on the 27th and 28th, more than 2 ins. being recorded in some parts of South Wales and North Devon.

October was unsettled throughout, and often very stormy, the wind rising on many occasions to the force of a strong gale

from the westward or south-westward. Until the closing week, when the wind got round to north or north-east, temperature was usually well above the average, the highest readings being observed on the 3rd and 4th, when the thermometer at one or two places in the north and east of England touched 70°. Heavy falls of rain were, however, frequent, the principal cases occurring in the following districts on the dates quoted:—(*a*) In Wales and the north-west of England on the 12th; (*b*) in Wales on the 14th, and in the south-west of England on the 15th; (*c*) in North Wales and the north-west of England on the 19th, and again on the 23rd; and (*d*) over the entire south-eastern quarter of England between the 26th and 28th. On the last-mentioned occasion the total quantity of rain in three days exceeded five inches in many parts of Kent and Sussex (where serious floods were reported), and amounted to more than six inches at Kearsney, the fall being equal to more than twice as much as the average for the whole of October,—normally the wettest month in the year.

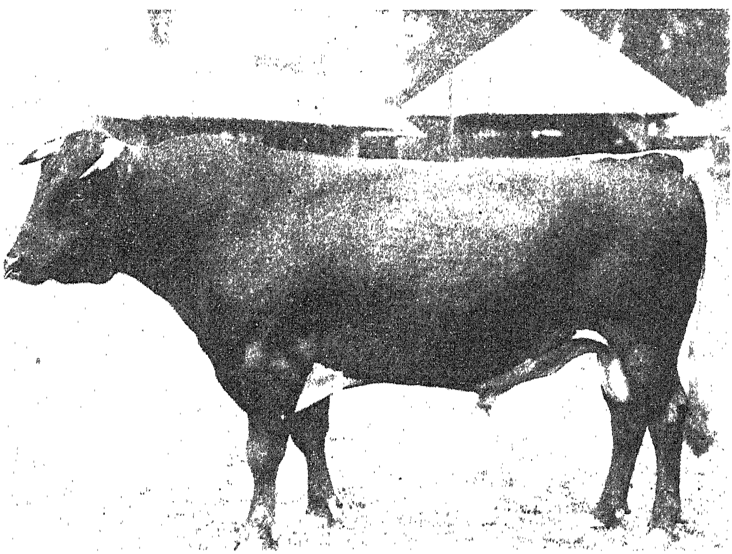
November witnessed a decided improvement in the weather, the rainfall over England being as a rule very small, and bright sunshine considerably in excess of the normal. Temperature was, however, very low, especially about the middle of the month, when a frost of unusual severity for the time of year occurred in all the more western and northern parts of the country. In the north of England the sheltered thermometer between the 14th and 16th fell below 20°, while in Scotland and the north of Ireland it sank below 15°, a reading as low as 3° being recorded at Balmoral. On the surface of the grass the thermometer at Balmoral fell to zero, while at Crathes, in Kincardineshire, it went 5° below zero. In the south and east of England the frost was of moderate intensity, and, with a marked absence of rain, farming operations, which had been much delayed by the heavy downpours of October, were resumed under fairly favourable conditions.

For the autumn as a whole the mean temperature was below the average, and the rainfall in excess in all but the north-eastern parts of the country. In the south-east of England the total amount was as much as 38 per cent. in excess of the normal. Less than the average amount of bright sunshine was recorded in all but the western districts, the deficiency being greatest in the eastern counties.

FREDERICK J. BRODIE.

12 Patten Road,
Wandsworth Common.

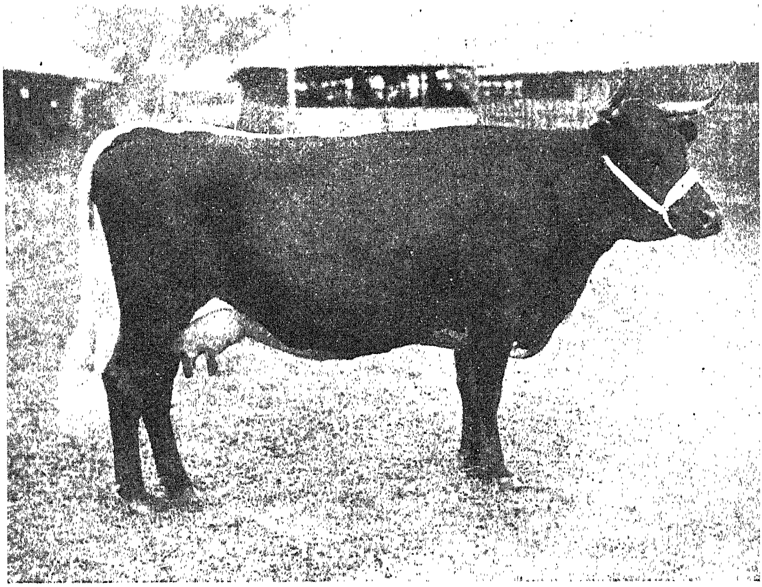
The Old Gloucestershire Breed of Cattle.—Great interest was aroused at the Gloucester Royal by a group of this breed, which were, however, "not for competition." The general appearance of the cattle will be gathered from the illustrations given here. The cow showed many points which indicate deep milking qualities. Her quarters were well shaped and long, the skin fine and mellow, the tail long and well carried, the chine beautifully formed and fine, and the rib well sprung and deep.



OLD GLOUCESTERSHIRE BULL, "JOCK."
Exhibited by the DUKE OF BEAUFORT, Gloucester, 1909

The back showed very typically the wedge shape so much admired by the milch-cow enthusiast. Only one bull was on exhibition, and even after making all allowance for difference of sex, it cannot be claimed that he showed as much quality as the cows. He was, nevertheless, a strong, robust looking beast, and slight failing in quality was atoned for by many indications of constitution. It was remarked by several from amongst the great numbers who inspected these cattle at the show, that the breed was very "Welsh" in type. This was no doubt true as

regards the bull, and to a certain, though much less, extent right concerning the cow. It might even be truthfully said that on close inspection the latter showed points both of limb and body which would please the Jersey man.



OLD GLOUCESTERSHIRE COW, "VIOLET."
Exhibited by the DUKE OF BEAUFORT, Gloucester, 1909.

Mr. McRow, the Secretary of the R.A.S.E., has kindly supplied the following extracts written in 1789 by Marshall in "The Rural Economy of Gloucestershire," pp. 213–218 :—

"The Gloucestershire breed of cattle is a variety of the middle horned species (see York. Econ., article Cattle). In size it forms a mean between the Norfolk and the Herefordshire breeds. (See Norf. Econ., article Cattle.) The head mostly small; neck long; shoulder fine; and all of them generally clean. The carcase mostly long, with the ribs full and the barrel large in proportion to the chest and hindquarters. The huckle of due width; but the nache frequently narrow. The bone, in general, fine; the hide thin and the hair short. The characteristic colour, dark red—provincially "brown"—with the face and neck inclining to black; and an irregular line of white along the back. The horns fine and rather long; but in some individuals placed awkwardly high on the fore head, and near at the roots; in others, however, they stand low and wide; winding with a double bend, in the middle-horn manner.

"The principal objections to the Gloucestershire breed of cattle are a deficiency in the chine and too great length of leg, giving the individuals of this description an awkward, uncouth appearance.

"But no wonder. The breed has not had a fair chance of excelling. I have heard of only one man, within memory, who ever paid any especial

attention to it, and this one man (Mr. Long, of Boddington) by some election strife (a curse in every county) was driven out of the vale about seven years ago, so that at present it may be said to lie in a state of neglect. Nevertheless it still contains individuals which are unobjectionable, particularly the remains of the Boddington breed, and with a little attention might, in my opinion, be rendered a very valuable breed of cattle.

"For dairy cows, I have not, in my own judgment, seen a better form. It is argued, however that the north country cows, being hardier, stand the winter better in the strawyard, and fat more kindly when they are dried off. It should be recollected, however, that Gloucestershire is a dairy county, and remembered that it was the Gloucestershire breed which raised the Gloucestershire dairy to its greatest height.

"The three classes, enumerated at the head of this article, now require to be separately considered.

"1. *Cows*. This being a dairy country the procuring of cows and the size of dairies, as well as the treatment, the application, and the disposal of cows, will require to be shown separately.

"(1.) Procuring. Dairymen in general rear their own cows; some, however, purchase the whole, and others part of their dairies.

"The point of a milch cow which is here principally attended to—and which, no doubt, is the main object of attention—is a large thin-skinned bag. I have, however, heard a large tail spoken of, in the true tone of superstition.

"The following are the dimensions of a cow of the Boddington breed. A genuine, and a fair specimen, as to form, but not as to size: the cows of that celebrated breed were, in general, considerably larger. As a milker she has had few equals; and, in my eyes, she is, or rather was, one of the handsomest and most desirable dairy cows I have yet seen. These dimensions were taken when she was five years old, off; she being then several months gone with her fourth calf.

"Height at the withers four feet three inches.
"Height of the fore dug twenty one inches.
"Smallest girt six feet and half an inch.
"Greatest girt seven feet eleven inches.
"Length from shoulder-knob to huckle four feet one inch.
"Length from the huckle to the out of the nache twenty inches.
"Width at the huckle twenty two inches.
"Width at the nache fourteen inches.
"Length of horn twelve inches.
"The eye full and bright.
"The ears remarkably large.
"The head fine and chap clean.
"The bosom deep; and the brisket broad, and projecting forward.
"The shoulders thin with the points snug.
"The thigh likewise thin, notwithstanding the great width at the nache.
"The bag large and hanging backward; being leathery and loose to the bearing.
"The teats of the middle size; gives much milk and holds it long.
"The tail large, the hide thin, and the bone remarkable fine.
"The colour a "dark brown"; marked with white along the back and about the udder; with the legs, chap, and head, of a full, glossy, dark, chocolate colour.
"The horns a polished white, tipped with black.

"The reasons given, by the dairymen of this district, for rearing their own cows are, "that they should soon be beggared if they had their cows to buy"; and "that they know what they breed, but do not know what they buy." The latter has much the most reason in it; for, as they observe, if a heifer is not likely to turn out well, they sell her; on the contrary, if they went to market for their cows, they must buy the outcasts of other breeders. Besides, they endeavour to breed from known good milkers; such as milk well, not only

presently after calving, but will hold their milk, through the summer, and the lattermath months; whereas in the market they are subject to chance, and the deceptions of drovers: the most they have to judge from is the size of the bag at the time of the purchase. In suitable situations, there can be little doubt of the propriety of every dairyman's rearing his own cows.

"The price of a cow and a calf of the Gloucestershire breed has been for the last ten years eight to ten or eleven pounds; of the north country sort ten to twelve or thirteen pounds."

Writing to Mr. McRow, Mr. Henry Bruton, of Gloucester, sends an extract from the catalogue of a sale held in October, 1896, when "about half the herd of Old Gloucestershire Cattle, the property of the Marquis of Worcester," were sold. From the interesting introduction we reproduce the following remarks:—

"This breed has been at Badminton from time immemorial. It is of the same variety as the once famous 'Glamorgan breed,' and its characteristics and markings are the same now as described by Youatt in his work on 'Cattle' at the end of the last century, when George III. had a number of them brought to Windsor every year. It is supposed that when Henry, the first Marquis of Worcester, surrendered Raglan Castle to the Cromwellian forces about 1646, and the estates were sequestrated, some of the cattle found their way to Badminton, which was purchased from Nicholas Boteler in 1613. In the early part of the present century the breed was generally kept in the county, and up to 1845 a herd was kept at Kingscote and also at Leonard Stanley." At Badminton the herd has been kept up to about one hundred head.

The account goes on to say that through inbreeding the cattle "began to deteriorate, and inquiries were made in Glamorganshire. A small herd was found at Llantrissant, belonging to Dr. William Price, from whom two cows and two bulls were purchased. His herd when seen in October, 1886, after the animals had been bought for Badminton, consisted of four cows, four heifers and one bull. Dr. Price, an eccentric gentleman who called himself a Druid, then in his eighty-sixth year, said that the breed was originally kept by his father, a clergyman at Pontypridd, and they were the only pure descendants of the old Glamorgan breed. As Dr. Price only lived on milk and eggs, bread, butter and cheese, flavoured with sage, they were kept for the dairy, and were good milkers, milking through from calf to calf, a point he greatly studied. They were very docile and gentle, but smaller in size, though of the same type as the Badminton cattle.

"From 10 to 14 quarts daily is the milk yield, and they live in the park all summer and in open yards in winter. The calves suck for ten days and are then put on a little skim milk, and turned out into the park without any artificial food. They are put to breeding when two years old from December to July. The herd under Mr. Tucker's careful management has during the last fifteen years been carefully drafted, but no record of the breeding or milk yield has been kept. Cows are rarely retained over eight years old. With better selection and management they appear to have somewhat increased in size. They weigh when killed from 800 to 1,000 lbs., and are excellent beef, the local butchers preferring them to others as they are simply fed on hay and water and 'die well.'"

We learn further that at this sale thirty head averaged 18*l.* 3*s.* Mr. Bruton, whom we have to thank for the trouble he has taken in connection with supplying information, writes to Mr. McRow in a subsequent letter: "I have seen Mr. Carter, of Harescombe, on whose farm there was an old herd of these

cattle. He reminded me that the pure bred cows should have their horns going 'outward and upward,' that the teats should be black, the nose and face a rich dark brown, that the belly should be white, and a streak of white running along the tail." This dark, almost black-red, colouring set off by the white markings, gives the breed a very distinct character.

The cattlemen in charge were enthusiastic in praise of their stock, and told us that the animals of this breed were seldom, if ever under a roof, and that notwithstanding this a cow sixteen years old, which in her prime had given 6½ gallons of good quality milk, made 21*l.* to the butcher when fat. Also that steers under three years old had been sold for 27*l.* In fact, did space allow, we might give a long list of their good qualities as detailed by the cowmen who talked about their cattle as only these high-class and intelligent members of the community can.

K. J. J. M.

Seed Potatoes.—It has been believed for years past, more especially in the East, South Midland, and Southern Districts of England, that potato "sets" planted direct from Scotland give a much greater yield than do "sets" grown from "stocks" which have been in England for several years. Latterly, carefully conducted experiments have decisively shown this to be the case. Under normal conditions Scottish seed will show an increase of from two to four tons per acre in the total yield over crops grown from a stock that has been in the districts mentioned *for three years or more.* The second season often shows an increase rather than otherwise in weight of crop and size of tubers, while it is the third and subsequent seasons which show a considerable falling off.

The real causes of this increase are not yet entirely known, but it is commonly believed that transference from a colder climate is one of the principal of them. Of late years, however, experiments have shown that "seed" from Ireland is equal to that from Scotland; in fact seed from County Cork was found to give a better result than seed from Cromarty. This fact suggests that some other reason be sought for.

To get anything approaching reliable results from comparative tests, such as are mentioned above, it is essential that the tubers to be compared should have had the same treatment in every way for at least two years, while it would be better still if they could be traced back to the parent stock. The fact that potatoes are called by the same name in different districts is by no means sufficiently conclusive.

In 1908 an experiment on potatoes was carried out at the Cambridge University Farm, under conditions which closely

fulfilled the requirements we have just noted. The object was to test the result, if any, of change due to the varying climatic conditions of a given country.

During an extended tour of inspection in Ireland in the year 1907, the writer was able to get together material for that experiment from various counties fairly representing the whole of the country. Very fortunately all the potatoes collected could be traced to a common parentage, thus giving the very stocks required for a careful study of the difference in cropping power which it has been supposed was due to differences of latitude.

In 1903 a gentleman in Mallow, County Cork, commenced to grow a variety known as Duchess of Cornwall—which is of the Up-to-Date type—and from a very small stock worked up seed for a fairly large acreage of this variety, the whole being treated in precisely the same way. For three seasons, commencing in 1905, he had been distributing this potato in different parts of the country, consequently in 1907 we were able to procure from the under-mentioned counties potatoes whose history for several years past was known. The counties are Waterford, Galway, Clare, Sligo, Queens', Down, Antrim, and Cork. Some seed also come from Queenstown.

Half a hundredweight of seed was obtained from each district, and in addition a similar quantity of the original stock from Mallow. They were planted in duplicate plots of $\frac{1}{80}$th acre, four rows to each plot. Each row had forty-nine tubers planted in it, and the weight of seed in each plot was from 20 to 21 lb.

Every care was taken to ensure as far as possible the results being accurately obtained.

The following table shows the total weights, and also the number of seasons the potatoes were grown after having been despatched from Mallow :—

No.	District from which seed was obtained	No. of years since original seed was brought from Mallow	Average weight of potatoes on the two plots. (Calculated at per acre.)	
			Tons	Cwts
1	Mallow, Co. Cork	—	11	4
2	Co. Down (E.)	3 years.	10	18
3	Co. Sligo (W.)	3 „	12	18
4	Co. Waterford (E.)	2 „	11	9
5	Co. Galway (W.)	2 „	13	2
6	Queens' County	2 „	12	14
7	Co. Antrim (E.)	2 „	10	7
8	Queenstown	2 „	10	19
9	Co. Clare (W.)	1 „	12	4

Comparing the figures given above for potatoes from Mallow (No. 1), and those from County Down (No. 2), and County Antrim (No. 7), we find that the potatoes which were kept in the South (at Mallow) gave heavier crops than those taken North. Judging by opinions held in England, this is not what might have been expected.

Looking at the results from the plots on the West (Nos. 3, 5, and 9), and comparing them with those on the East (Nos. 2, 4, and 7), we find that there is a difference on the average of nearly two tons per acre in favour of the West. A somewhat similar result might be anticipated in England if crops produced on the West side were compared with those grown on the East.

The experiment certainly strengthens the idea already gained that the vigour of potato sets is not dependent on their being grown in the North, but that it is due to either—

(1) More moisture in the atmosphere during the period of growth, or—

(2) Less sunshine during the time of ripening, that is to say the potato top gradually decays and dies down, instead of more or less rapidly decomposing.

It is not intended to make any definite assertions, but rather to suggest other conditions besides that of latitude, which may account for the well-known vigour of Scotch seed, and it is to be hoped that further research work may be carried out somewhat on the lines referred to above so as to enable us to get some more reliable confirmation of the theories suggested.

H. HENSHAW.

University Farm,
Cambridge,
December, 1909.

Rural Education.—I would like to draw the attention of the members of the Royal Agricultural Society to M. Vuyst's book on agricultural education.[1] The first section deals with elementary schools, and to my mind much that he says applies to the condition of affairs in rural England. He lays great stress on the method of giving agricultural instruction, and though perhaps Belgium is not so much to the fore in secondary and higher agricultural education as some other countries, it has succeeded admirably in making agricultural education and practical study of Nature an integral part of elementary school life. M. Astier, in his book reviewing the present condition of technical instruction in different countries of the world, makes

[1] "L'enseignement agricole et ses méthodes," by M. De Vuyst, Chief Inspector of Agriculture to the Kingdom of Belgium.

a very encouraging and complimentary review of the way in which we have improved our purely technical education in England during the past ten years, and he maintains that we have quite regained the leading position in that branch of education as far as the upper skilled artisans and commercial men are concerned. This is encouraging, but we are still far behind other nations in the practical manual instruction given in ordinary rural schools. There is a striking paragraph in the Report of the Royal Commission on the Poor Law:—"Much evidence has been submitted that the present system of elementary education is not adapted to the wants of an industrial country." "It is not in the interest of the country to produce by our system of education a dislike of manual work and a taste for clerical and intermittent work when the majority of those so educated must maintain themselves by manual work."

C. T.

Destruction of Thistles.—It is notorious that, whenever the thistle (*Carduus arvensis*) comes up for discussion among farmers, views are expressed which show divergences of opinion that can hardly be exceeded in the case of any other subject likely to be debated. Professor Hedworth Foulkes is therefore to be congratulated on having, during the last three years, carried out experiments on the extermination of this pest at the Harper-Adams Agricultural College, over which he presides.

On a grass field belonging to the College, and which had been regularly grazed with mixed stock, the common creeping thistle was very plentiful. In 1907 trial plots were laid out, and dealt with as described in the following extract:—

The first two years the plots were treated as follows:—

Plot 1.—Thistles cut three times in the season and dressed with 4 cwt. common salt after each cutting. (Cut June 10, July 9, and 17).

Plot 1a.—Thistles cut three times in season, not salted.

Plot 2.—Thistles cut once in season and dressed with 4 cwt. salt at time of cutting.

Plot 2a.—Thistles cut once in season, not salted.

Plot 3.—Not cut, but headed with stick to prevent seeding, and dressed with 4 cwt. salt at same time.

Plot 3a.—Not cut, but headed.

Plot 4.—Cut once and sprayed with sulphate of copper.

Plot 4a.—Uncut, but headed with stick and sprayed with sulphate of copper.

In 1909 the use of sulphate of copper was discontinued, and plots 3a and 4a were cut three times, while in the case of plots 1 and 1a, there were practically no thistles present for the third cutting.

Principal Foulkes has been kind enough to communicate the following remarks concerning the results obtained. Before these notes are read, it may be well to emphasise the fact that

it was the *creeping thistle* that was under treatment, for when present at discussions on this subject at Farmers' Clubs and elsewhere, an attentive listener may sometimes conclude that the difference in habit of growth between this pest and other thistles infesting grass land is not duly considered.

Leaflet No. 166, published by the Board of Agriculture, so clearly brings out this difference that no further description is here necessary, and we give Professor Foulkes' remarks without further comment :—

The conclusions that may be drawn from the trials are, that by checking the growth of the thistle above ground in the early summer, the development of the underground stem is hindered, and the plant cannot spread so freely. The second growth which follows is not so strong, and the seed-producing stems are not so luxuriant. Second cutting in July further weakens the vigour of the plant, and this is further checked by the third cutting in the first year. The same treatment in the second season leaves a very much reduced crop, and by the time of the third cutting there is very little left to deal with, either in the number or in the strength of the thistle plants.

By 1909 the treatment on plots 1 and 1a may be said to have practically cleared the plots.

Any definite time of cutting cannot be laid down, as varying seasons affect the plant's growth, but cutting is best done when plants are from four to six inches above ground.

Another feature noticed was that the herbage on the plots which were cut frequently was much more abundant and freely grazed, whereas on such plots as 3, 3a, and 4a, there was practically nothing consumed by the stock.

The results of the trial tended to prove that salt and sulphate of copper have little, if any, effect upon the thistle.

(Signed) P. HEDWORTH FOULKES.

Fertilisers and Manures.—A. D. Hall, M.A., F.R.S.—Those of our readers who have derived both pleasure and profit from the perusal of Mr. Hall's instructive book, *The Soil*—and there must be many such—will take up with pleasurable anticipations the companion volume, *Fertilisers and Manures*,[1] from the same able pen. It has recently been published and forms the second of a series which will be completed by a third volume dealing with the chemistry of the growing plant. And they will not be disappointed ; we know of no work to be compared with this in lucid exposition and acute appreciation of modern research on a difficult subject. Since the abandonment of the systems of manuring based on the crude conceptions of Liebig, the field has been occupied by such a mass of theories and ideas that it required a writer of no ordinary ability to reduce the chaos to order, and point out the path of sanity and reason. And this is what the Director of the Lawes Institute has accomplished. In his preface, Mr. Hall very rightly declares

[1] *Fertilisers and Manures*. A. D. Hall, M.A., F.R.S., Director of the Rothamsted Experimental Station, Foreign Member of the Royal Academy of Agriculture in Sweden. London : John Murray. July, 1909. 5*s*. net. pp. 384+x.

that the future lies with intensive farming, and that as science every year puts fresh weapons in the hands of the farmer it is essential that he should have skill and knowledge in wielding them. The author's ideal is to teach the farmer to reason out for himself the scheme of manuring best suited to his soil and style of farming, by explaining the mode of action of the various manures, and their relation to different crops and soils. He is especially to be commended in our opinion for insisting that there is no universal best way of manuring, and that the proper business of the expert is to lay down, as far as he can, principles which the practical man must learn to apply to his own conditions. The style of the book throughout is lucid and non-technical, and no space is wasted on details of the methods of manufacture of fertilisers, matter which possesses no interest for the practical man.

After an introduction, which is mainly historical, Mr. Hall devotes a number of chapters to nitrogenous manures, phosphatic and potassic fertilisers, farmyard manure, guanos, and theories of fertiliser action. We found the last-mentioned chapter very interesting, particularly the criticism of the American doctrines as to the uselessness of fertilisers as direct plant-foods. Though the author cannot bring himself to agree with the heretical views of the American school, nevertheless we feel that, in view of his recent researches on the infusorial population of the soil, and his advocacy of soil surveys, he would be the first to admit that a purely chemical view of the action of fertilisers is insufficient to explain all the beneficial effects that follow their use. Another criticism we would offer, with extreme diffidence, is in relation to the vexed question of residual values. If it be true, as stated on page 205, that though the superiority of cake-fed dung may be seen in the second or third year it is almost covered by the experimental error, why do the tables prepared by the author, in collaboration with Dr. Voelcker, give a residual value to cake up to the third and fourth year?

The chapters that follow on the manurial treatment appropriate to the principal farm crops are those in which the farmer will find the most interesting matter, for they are largely based on the result of field experiments, and are consequently independent of theory; they are especially illuminating in the emphasis they give to the variations that the system of farming in operation necessitates in the scheme of manuring. Every farmer should become thoroughly conversant with the principles and methods laid down in the chapter on the valuation and purchase of manures; if the lessons they convey should have the effect of diminishing the credit of proprietary "special mixtures," a great advance in agricultural education will have been made.

We can confidently recommend this book both to the expert and the farmer; it fitly maintains the credit of the oldest and most renowned agricultural experimental station in this country.

A. B. B.

Milk Testing.—C. W. Walker-Tisdale.—All cow-keeping farmers who depend upon milk-selling for a considerable proportion of their income must feel that the *quality* of milk is at this present time much more generally held to be of importance to the public than it was in the past; and looking to the future, it is evident that the time is coming when this question of quality will be all important. To all who appreciate this truth we can thoroughly recommend this little book.[1] Mr. Walker-Tisdale is particularly well qualified to write such a treatise, for to thorough scientific knowledge he adds considerable practical experience. In this work he has written directions which any "rule-of-thumb" man can carry out for himself, while on the other hand he has put at the service of the student and the expert a great deal of his scientific experience which, one would point out, is very great for an author whom one may still class, as regards age, as one of the junior men of the day. If, as doubtless will be the case, a second edition of this work is published, one or two misprints should be corrected. Such as where the "Test Bottle," page 30, is said to be in the "position for reading fat," whereas it is upside down. "The solids are heavier than the liquids" is a statement on page 17 which is apt to be confusing, butter fat being, as we know, lighter than the milk serum. In another part of the book (page 12) we find the following; "and these solids are usually divided into the fat portion and the . . . . ." Yet at page 17 under the heading "Specific Gravity," the "fatty part" is written about as a "liquid part."

The fact that the pages of this small volume (which only costs a shilling) contain a certain number of rather scientific looking words, a few formulas, and some calculations, should not be excuse enough for the "old-fashioned practical man" to refuse to read it, for all the matter wanted by the farmer is clearly, tersely, and simply set out.

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[1] *Milk Testing.* C. W. Walker-Tisdale, F.C.S., N.D.D. W. R. Smithson, Northallerton. April, 1909. 1*s.* net. pp. 75.

GARRETT TAYLOR.

A WELL-KNOWN figure in the agricultural world has been removed by the death of Mr. Garrett Taylor, of Trowse House, Norwich, which occurred on December 31, 1909, in his sixty-eighth year.

He joined the Society as a Member in the year 1875, and in 1889 was elected to the Council, in which office he continued until the year 1905, when, in consequence of increasing engagements, he felt it necessary to retire. When the Show was held at Norwich in 1886 Mr. Garrett Taylor was Local Honorary Secretary, and as Agent of the late Mr. Jeremiah Colman, who owned the site of this Showyard, had much to do with the improvements which were carried out, with the result that the Showyard was of the most convenient and perfect character. Mr. Taylor was Steward of Live Stock from 1894 to 1897, occupying the position of Senior Steward at the great Show at Manchester in the year of Queen Victoria's Diamond Jubilee. Amongst the many other positions held by him in connection with the farming interests was that of Chairman of the Royal Agricultural Hall Company from the year 1901 until his death.

When the question of the Society visiting Norfolk in 1911 was decided, and the invitation from Norwich accepted, Mr. Garrett Taylor was again appointed Local Honorary Secretary with Mr. E. W. Beck, of Norwich, as his colleague.

He was well known as a practical agriculturist, and had an extensive practice as a land agent. As a judge of several kinds of live stock his services were in request by many of the agricultural societies in the United Kingdom.

In 1885 Mr. Taylor acted as one of the Judges of the Farm Prizes Competitions in connection with the Society's Show held that year at Preston, and in 1886 the First Prize of 100*l.* for the best managed arable and grass farm exceeding 550 acres, in the counties of Norfolk and Suffolk, was awarded to him for the Whitlingham Hall Farm, which was upwards of 1,300 acres in extent.

Mr. Taylor was an active Member of the Council of this Society, and his loss will long be regretted and his usefulness remembered by his colleagues as well as by many of the general body of Members.

His many public services to the county of Norfolk will serve as a memorial to the courage and zeal with which he carried out everything he undertook to do.

T. M.

Royal Agricultural Society of England.

Patron.

HIS MOST GRACIOUS MAJESTY THE KING.

President for 1910.

Sir GILBERT GREENALL, Bart.

Trustees.

Year when first elected on Council	
1895	H.R.H. THE PRINCE OF WALES, K.G., *Marlborough House, S.W.*
1895	BEDFORD, Duke of, K.G., *Woburn Abbey, Bedfordshire.*
1871	BOWEN-JONES, J., *St. Mary's Court, Shrewsbury.*
1882	CAWDOR, Earl, *Stackpole Court, Pembrokeshire.*
1893	CORNWALLIS, F. S. W., *Linton Park, Maidstone, Kent.*
1885	COVENTRY, Earl of, *Croome Court, Severn Stoke, Worcestershire.*
1898	DEVONSHIRE, Duke of, *Chatsworth, Chesterfield.*
1881	GILBEY, Sir WALTER, Bart., *Elsenham Hall, Elsenham, Essex.*
1883	JERSEY, Earl of, G.C.B., G.C.M.G., *Middleton Park, Bicester, Oxon.*
1899	MIDDLETON, Lord, *Birdsall House, York.*
1880	MORETON, Lord, *Sarsden House, Chipping Norton, Oxon.*
1881	THOROLD, Sir JOHN H., Bart., *Syston Park, Grantham, Lincolnshire.*

Vice-Presidents.

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1891	DUGDALE, J. MARSHALL, *Llwyn, Llanfyllin, S.O., Mont.*
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1899	NORTHBROOK, Earl of, *Stratton, Micheldever, Hampshire.*
1908	NORTHUMBERLAND, Duke of, K.G., *Alnwick Castle, Northumberland.*
1881	PARKER, Hon. CECIL T., *Eccleston, Chester.*
1907	YARBOROUGH, Earl of, *Brocklesby Park, Lincolnshire.*

Ordinary Members of the Council.

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1905	AVELING, THOMAS L., *Boley Hill House, Rochester (Kent).*
1906	BROCKLEHURST, HENRY DENT, *Sudeley Castle, Winchcombe (Glos.).*
1909	BROCKLEHURST, Maj.-Gen., *Ranksborough, Oakham (Rutland).*
1906	BUTTAR, THOMAS A., *Corston, Coupar Angus (Scotland).*
1905	CARDEN, RICHARD G., *Montebello, Killiney, Co. Dublin (Ireland).*
1905	CARR, RICHARDSON, *Estate Office, Tring Park (Hertfordshire).*
1905	COOPER, Sir RICHARD P., Bart., *Shenstone Court, Lichfield (Staffs).*
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1906	DUDDING, HENRY, *Riby Grove, Stallingborough (Lincolnshire).*
1905	EADIE, JOHN T. C., *The Rock, Newton Solney (Derbyshire).*
1905	FALCONER, JAMES, *Northbrook Farm, Micheldever Station (Hampshire).*
1907	FRANK, HOWARD, 9 *Conduit Street, W. (London).*
1909	GARNE, W. T., *Aldsworth, Northleach (Gloucestershire).*
1906	GLOVER, JAMES W., *Beechwood, Warwick (Warwickshire).*
1900	GREAVES, R. M., *Wern, Portmadoc (North Wales).*
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1905	HARRIS, JOSEPH, *Brackenbrough Tower, Carlisle (Cumberland).*
1903	HARRISON, WILLIAM, *Hall House, Leigh (Lancashire).*
1909	HAZLERIGG, Sir ARTHUR G., Bart., *Noseley Hall, Leicester.*
1910	HENDERSON, Major H. G., M.P., *Kitemore, Faringdon (Berkshire).*

Year when first elected on Council	Ordinary Members of the Council (continued).
1905	HINE, JOHN HENRY, *Pomphlett Farm, Plymstock, Plymouth (Devon).*
1906	HIPPISLEY, R. J. BAYNTUN, *Ston Easton Park, near Bath (Somerset).*
1905	HISCOCK, ARTHUR, *Manor Farm, Motcombe, Shaftesbury (Dorset).*
1903	HOBBS, ROBERT W., *Kelmscott, Lechlade (Oxfordshire).*
1908	HOSKEN, W. J., *Pulsack, Hayle (Cornwall).*
1900	HOWARD, JOHN HOWARD, *Clapham Park, near Bedford (Bedfordshire)*
1905	INGRAM, WALTER F., 2 *St. Andrew's Place, Lewes (Sussex).*
1905	KNIGHTLEY, Sir CHARLES V., Bart., *Fawsley, Daventry (Northants).*
1909	LUDDINGTON, J. L., *Littleport (Cambridgeshire).*
1909	MANSELL, ALFRED, *College Hill, Shrewsbury (Shropshire).*
1904	MATHEWS, ERNEST, *Little Shardeloes, Amersham (Buckinghamshire).*
1905	MAY, WILLIAM A., 3 *Wellington Street, Strand, W.C. (London).*
1904	MIDDLETON, CHRISTOPHER, *Vane Terrace, Darlington (Durham).*
1884	MILLER, T. HORROCKS, *Singleton Park, Poulton-le-Fylde (Lancashire).*
1905	MINTON, THOMAS S., *Montford, Shrewsbury (Shropshire).*
1907	NOCTON, WILLIAM, *Langham Hall, Colchester (Essex).*
1909	PATTERSON, R. G., *Acton Hill, Stafford (Staffordshire).*
1905	PILKINGTON, CLAUDE M. S., *Wollaton, Nottingham (Nottinghamshire).*
1906	PLUMPTRE, H. FITZWALTER, *Goodnestone, Dover (Kent).*
1909	PROUT, W. A., *Sawbridgeworth, Herts. (London).*
1905	REA, GEORGE GREY, *Middleton, Wooler (Northumberland).*
1897	REYNARD, FREDERICK, *Sunderlandwick, Driffield (Yorks., E. Riding).*
1905	RICHMOND AND GORDON, Duke of, K.G., *Goodwood, Chichester (Sussex).*
1908	RIDLEY, Viscount, *Blagdon, Cramlington (Northumberland).*
1897	ROGERS, C. COLTMAN, *Stanage Park, Brampton Bryan (South Wales).*
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1907	SMITH, FRED, *Woodbridge (Suffolk).*
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1891	STANYFORTH, E. WILFRID, *Kirk Hammerton Hall, York (Yorks., W.R.).*
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1905	TAYLOR, GEORGE, *Cranford (Middlesex).*
1907	TINDALL, C. W., *Wainfleet (Lincolnshire).*
1904	TURNER, ARTHUR P., *The Leen, Pembridge (Herefordshire).*
1889	WHEELER, E. VINCENT V., *Newnham Court, Tenbury (Worcestershire).*
1889	WILSON, C. W., *Rigmaden Park, Kirkby Lonsdale (Westmorland).*
1908	WRIGLEY, LOUIS C., *Trellick Grange, Chepstow (Monmouthshire).*

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DISTRIBUTION OF GOVERNORS AND MEMBERS OF THE SOCIETY, AND OF ORDINARY MEMBERS OF THE COUNCIL.

Electoral District	Division	Number of Governors and Members	Number of Ordinary Members of Council	Ordinary Members of Council
A.	Bedfordshire	92	1	J. H. Howard.
	Cheshire	258	1	Hon. J. E. Cross.
	Cornwall	93	1	W. J. Hosken.
	Derbyshire	163	1	J. T. C. Eadie.
	Dorset	78	1	A. Hiscock.
	Hampshire and Channel Islands	237	1	J. Falconer.
	Hertfordshire	267	1	Richardson Carr.
	Lancashire and Isle of Man	346	2	W. Harrison; T. H. Miller.
	Middlesex	132	1	G. Taylor.
	Monmouthshire	61	1	L. C. Wrigley.
	Norfolk	314	1	H. Tallent.
	Northamptonshire	199	1	Sir C. V. Knightley.
	Northumberland	306	2	G. G. Rea; Viscount Ridley.
	Staffordshire	302	2	Sir R. P. Cooper; R. G. Patterson.
	Worcestershire	198	1	E. V. V. Wheeler.
	Yorkshire, N.R.	178	1	W. Scoby.
	Scotland	226	1	T. A. Buttar.
		—3,450	—20	
B.	Buckinghamshire	171	1	E. Mathews.
	Devon	160	1	J. H. Hine.
	Durham	147	1	C. Middleton.
	Essex	211	1	W. Nocton.
	Herefordshire	144	1	A. P. Turner.
	Leicestershire	249	1	Sir A. G. Hazlerigg.
	London	578	3	Howard Frank; W. A. May; W. A. Prout.
	Nottinghamshire	154	1	C. M. S. Pilkington.
	Rutland	22	1	Maj.-Gen. J. F. Brocklehurst.
	Shropshire	322	2	Alfred Mansell; T. S. Minton.
	Suffolk	234	1	Fred Smith.
	Surrey	227	1	E. A. Hamlyn.
	Wiltshire	130	1	H. H. Smith.
	Yorkshire, W.R.	252	1	E. W. Stanyforth.
	South Wales	104	1	C. C. Rogers.
		—3,105	—18	
C.	Berkshire	213	1	Capt. H. G. Henderson, M.P.
	Cambridgeshire	165	1	J. L. Luddington.
	Cumberland	118	1	Joseph Harris.
	Glamorgan	80	1	D. T. Alexander.
	Gloucestershire	391	2	H. D. Brocklehurst; W. T. Garne.
	Huntingdonshire	43	1	John Rowell.
	Kent	401	2	T. L. Aveling; H. F. Plumptre.
	Lincolnshire	358	2	Henry Dudding; C. W. Tindall.
	Oxfordshire	180	1	R. W. Hobbs.
	Somerset	123	1	R. J. Bayntun Hippisley.
	Sussex	304	2	W. F. Ingram; Duke of Richmond and Gordon.
	Warwickshire	254	1	J. W. Glover.
	Westmorland	58	1	C. W. Wilson.
	Yorkshire, E.R.	109	1	F. Reynard.
	Ireland	132	1	R. G. Carden.
	North Wales	164	1	R. M. Greaves.
		—3,093	—20	
Foreign Countries		282		
Members with no Addresses		16		
Grand Totals		9,946	58	

Table showing the Number of GOVERNORS and MEMBERS in each Year from the Establishment of the Society.

Year ending with Show of	President of the Year	Governors		Members			Total.
		Life	Annual	Life	Annual	Honorary	
1839	3rd Earl Spencer	—	—	—	—	—	1,100
1840	5th Duke of Richmond	86	189	146	2,434	5	2,860
1841	Mr. Philip Pusey	91	219	231	4,047	7	4,595
1842	Mr. Henry Handley	101	211	328	5,194	15	5,849
1843	4th Earl of Hardwicke	94	209	429	6,155	15	6,902
1844	3rd Earl Spencer	95	214	442	6.161	15	6,927
1845	5th Duke of Richmond	94	198	527	5,899	15	6,733
1846	1st Viscount Portman	92	201	554	6,105	19	6,971
1847	6th Earl of Egmont	91	195	607	5,478	20	6,391
1848	2nd Earl of Yarborough	93	186	648	5,387	21	6,335
1849	3rd Earl of Chichester	89	178	582	4.643	20	5,512
1850	4th Marquis of Downshire	90	169	627	4,356	19	5,261
1851	5th Duke of Richmond	91	162	674	4,175	19	5,121
1852	2nd Earl of Ducie	93	156	711	4,002	19	4,981
1853	2nd Lord Ashburton	90	147	739	3,928	19	4,923
1854	Mr. Philip Pusey	88	146	771	4,152	20	5,177
1855	Mr. William Miles, M.P.	89	141	795	3.838	19	4,882
1856	1st Viscount Portman	85	139	839	3,896	20	4,979
1857	Viscount Ossington	83	137	896	3,933	19	5,068
1858	6th Lord Berners	81	133	904	4,010	18	5,146
1859	7th Duke of Marlborough	78	130	927	4,008	18	5,161
1860	5th Lord Walsingham	72	119	927	4,047	18	5,183
1861	4th Earl of Powis	84	90	1,113	3,328	18	4,633
1862	H.R.H. The Prince Consort 1st Viscount Portman	83	97	1,151	3,475	17	4,823
1863	Viscount Eversley	80	88	1,263	3,735	17	5,183
1864	2nd Lord Feversham	78	45	1,343	4,013	17	5,496
1865	Sir E. C. Kerrison, Bart., M.P.	79	81	1,386	4,190	16	5,752
1866	1st Lord Tredegar	79	84	1,395	4,049	15	5,622
1867	Mr. H. S. Thompson	77	82	1,388	3,903	15	5,465
1868	6th Duke of Richmond	75	74	1,409	3,888	15	5,461
1869	H.R.H. The Prince of Wales, K.G.	75	73	1,417	3,864	17	5,446
1870	7th Duke of Devonshire	74	74	1,511	3,764	15	5,438
1871	6th Lord Vernon	72	74	1,589	3,896	17	5,648
1872	Sir W. W. Wynn, Bart., M.P.	71	73	1,655	3,953	14	5,766
1873	Earl Cathcart	74	62	1,832	3,936	12	5,916
1874	Mr. Edward Holland	76	58	1,944	3,756	12	5,846
1875	Viscount Bridport	79	79	2,058	3,918	11	6,145
1876	2nd Lord Chesham	83	78	2,164	4,013	11	6,349
1877	Lord Skelmersdale	81	76	2,239	4,073	17	6,486
1878	Col. Kingscote, C.B., M.P.	81	72	2,328	4.130	26	6,637
1879	H.R.H. The Prince of Wales, K.G.	81	72	2,453	4,700	26	7,332
1880	9th Duke of Bedford	83	70	2,673	5, 83	20	7,929
1881	Mr. William Wells	85	69	2,765	5,041	19	7,979
1882	Mr. John Dent Dent	82	71	2,849	5,059	19	8,080
1883	6th Duke of Richmond and Gordon	78	71	2,979	4,952	19	8,099
1884	Sir Brandreth Gibbs	72	72	3,203	5.408	21	8,776
1885	Sir M. Lopes, Bart., M.P.	71	69	3,356	5,619	20	9,135
1886	H.R.H. The Prince of Wales, K.G.	70	61	3,414	5,569	20	9,134
1887	Lord Egerton of Tatton	71	64	3,440	5,387	20	8.982
1888	Sir M. W. Ridley, Bart., M.P.	66	56	3,521	5,225	16	8,884
1889	HER MAJESTY QUEEN VICTORIA	73	58	3,567	7,153	15	10,866
1890	Lord Moreton	122	58	3,846	6,941	17	10,984
1891	2nd Earl of Ravensworth	117	60	3,811	6 921	19	10,928
1892	Earl of Feversham	111	69	3,784	7,066	20	11,050
1893	1st Duke of Westminster, K.G.	107	74	3,786	7,138	21	11,126
1894	8th Duke of Devonshire, K.G.	113	73	3,798	7,212	22	11,218
1895	Sir J. H. Thorold, Bart.	120	80	3,747	7,179	23	11,149
1896	Sir Walter Gilbey, Bart	126	83	3,695	7,253	23	11,180
1897	H.R.H. The Duke of York, K.G.	126	83	3,705	7,285	24	11,223
1898	Earl Spencer, K.G.	121	79	3,687	7,182	25	11,094
1899	Earl of Coventry	116	75	3,656	7,009	23	10,879
1900	H.R.H. The Prince of Wales, K.G.	111	71	3,628	6,832	24	10,666
1901	Earl Cawdor	102	70	3,564	6,338	27	10,033
1902	H.R.H. Prince Christian, K.G.	100	69	3,500	5,955	26	9,650
1903	H.R.H. The Prince of Wales, K.G.	99	62	3,439	5,771	27	9,398
1904	16th Earl of Derby, K.G.	96	68	3,375	5,906	32	9,477
1905	Lord Middleton	95	72	3,270	5,808	31	9,276
1906	Mr. F. S. W. Cornwallis	94	155	3,182	6, 89	30	9,600
1907	Earl of Yarborough	91	174	3,076	6,299	29	9,669
1908	Duke of Devonshire	89	178	3,019	6,442	30	9,758
1909	Earl of Jersey, G.C.B.	91	177	2,951	6,696	31	9,946

STATEMENT made to the Council by the Chairman of the Finance Committee, on presenting the Accounts for the year 1909.

Mr. ADEANE explained that he had to deal with the accounts for the past year. So far as finances were concerned, the Society had got into a regular stride. The figures under the various heads differed little from year to year, and therefore he need not detain the Council long.

The expenditure for the year 1909 was 8,356*l.*, or 478*l.* more than in the year 1908. There was an increase of 253*l.* under the head of administration. This was due to the increase in the salaries of the staff, to the honorarium to the Secretary, which they had been glad to vote last year, to the professional charges, and to the re-arrangement of the Library. Under the head of Journal there was an excess of expenditure of 80*l.* over what had been allowed for 1908, which was largely due to the considerable expense of including in the Journal the Report on the Competition for Plans of Farm Buildings. Last year the allowance for the Journal had been raised to 700*l.*, but he was sorry to say that there had again been an excess of 30*l.*, making on the two Journals, Volumes 69 and 70, an excess of 110*l.* The Journal Committee was going into the question very carefully, in the hope that in the future it would be possible to keep within the figure allotted. If their membership increased, the expenses of the Journal would increase also, on account of the extra number of copies that would have to be issued. The Trials of Hop Drying Plants had cost 68*l.* more than was estimated, and in this connection he would like, on behalf of the Council, to take the opportunity of thanking those gentlemen—without whose assistance the Trials could not have been held—for the immense amount of trouble they had taken in collecting money and for subscribing very generously to the Fund themselves. The names of the gentlemen were Mr. Cornwallis, Mr. Aveling, Mr. Wheeler, and Mr. Plumptre.

With regard to receipts, the income for the year showed an increase of 509*l.* Subscriptions had increased by 320*l.*, and investments showed an increase of 385*l.* The total income was 8,951*l.*, and the expenditure was 8,356, leaving the Society a credit balance of 595*l.*

Very little need be said about the balance-sheet, but that little would be satisfactory. The capital of the Society at the end of 1908 was 43,592*l.* Last year they added to the capital the sum of 4,124*l.*, making the total capital at the end of 1909 47,716*l.* The Reserve Fund at the end of 1908 was 36,029*l.*, and at the end of 1909 it was 40,400*l.*

FORECAST OF ORDINARY RECEIPTS AND EXPENDITURE FOR 1910.

(Other than in respect of the Show.)

Prepared by direction of the Finance Committee on the basis of the recommendations of September 21, 1905, made by the Special Committee.

Actual Figures for 1909.	*Receipts.*	
£		£
7,707	From Subscriptions for 1910 of Governors and Members	7,700
76	From Interest on Daily Balances	100
939	From Interest on Investments	1,150
229	From Sales of Text Book, Pamphlets, &c. (This does not include the sales of Journals, which are deducted from the cost of production)	250
8,951		9,200

	Expenditure.	
£		£
1,587	Salary of Secretary and Official Staff	1,586
40	Pensions to Officials	215
737	Rent, Lighting, Cleaning, Wages, &c. (say)	700
384	Printing and Stationery	400
190	Postage and Telegrams	200
396	Miscellaneous	400
730	Journal	710
615	Chemical Department	600
250	Botanical Department	250
200	Zoological Department	200
202	Veterinary Department	200
196	Examinations for National Diplomas (R.A.S.E. Share)	200
5,527		5,661

£		£
5,527	Brought forward	5,661
100		
150		
	Exceptional Expenditure.	
	Furniture, apparatus and fittings for Society's Botanist and Zoologist at School of Agriculture, Cambridge	100
	Painting and repairs, 16 Bedford Square	70
79	Preparing Catalogue for Library, and Binding Books	50
	Reprint of 1,000 copies of Text Book	80
	Contribution towards Motor Trials	400
2,500	Contribution from Governors' and Members' Subscriptions to the expenses of the Annual Show	2,500
8,356	Total Estimated Expenditure	8,861

	£
Estimated Receipts	9,200
Estimated Expenditure	8,861
Estimated Receipts over Expenditure	339

Coming to the estimates for the present year, under the head of receipts, the Finance Committee expected from Subscriptions of Governors and Members 7,700*l.*, from Interest on Daily Balances, 100*l.*, from Interest on Investments 1,150*l.*, from Sales of Text Book, Pamphlets, &c., 250*l.*, giving an estimated income for the year of 9,200*l.* On the expenditure side they estimated that the salaries of the Official Staff would be the same as last year, 1,586*l.* Pensions to Officials would be 215*l.*, a larger sum than last year, because it included half a year's salary to Mr. Carruthers and also one half year's pension. The Rent, Lighting, &c., was estimated at 700*l.*, Printing and Stationery 400*l.*, Postage and Telegrams 200*l.*, and Miscellaneous 400*l.* To the Journal they had allotted 710*l.*, as they felt it was only fair that another 10*l.* should be allowed in view of increased membership. The number of Members of the Society at the present time was 9,946, and since the end of 1905 they had increased their membership by 776. For the Chemical Department they estimated 600*l.*, Botanical 250*l.*, Zoological 200*l.*, Veterinary 200*l.*, and Examinations for National Diplomas 200*l.* Under the head of exceptional expenditure they asked the Council to allow the sum of 100*l.* for furniture, apparatus, and fittings required for the two rooms which had been generously placed at the disposal of the Society for their Botanist and Zoologist by the University of Cambridge in their new buildings. Under the terms of the lease of 16 Bedford Square, they were bound to paint the outside of the house every three years, and the cost of this work would be about 70*l.* The expenses of preparing Catalogue for Library and binding books would be 50*l.* Last year they asked the Council to vote 250*l.* towards printing 5,000 copies of the Text Book, and only 94*l.* of that sum had been expended. The demand for the Text Book was still very great, and few copies were left. They now asked for 80*l.* to reprint 1,000 copies. The Finance Committee had requested the Journal Committee to go very carefully into the question of the revision of the Text Book, and to submit an estimate of the cost, but of course nothing would be done before the matter had been brought before the Council. 400*l.* was to be contributed toward the Agricultural Motor Trials. The Society felt that it must undertake these important trials, which would be extremely expensive. The Chairman of the Implement Committee had given him the figure of 400*l.* as an approximate one. It was felt that it would not be fair to put that charge entirely on the Show Fund, and therefore it was proposed to make a contribution of 400*l.* out of the Society's ordinary funds towards the expenses of these trials. The remaining item was the usual contribution of 2,500*l.* from the Subscriptions of Governors and Members to the Show Fund. The total estimated expenditure was 8,861*l.*, and the receipts 9,200*l.*, giving an estimated credit balance for the year of 339*l.*

In conclusion, Mr. ADEANE hoped the Council would consider that the Society was financially in a satisfactory condition, but they had still a great deal to do. He had heard a whisper that they were thought to be hoarding treasure, which was quite a new accusation to level against the Society. He would like to put it in a different way. They were attempting to build up such a reserve as would make their position absolutely stable, and that would give them the freedom that was necessary if they were to carry out their work with the utmost efficiency.

Royal Agricultural Society of England.

STATEMENT OF FUNDS HELD BY THE SOCIETY IN TRUST OR WHICH ARE NOT CONSIDERED AVAILABLE FOR GENERAL PURPOSES, DECEMBER 31, 1909.

	£	s.	d.					£	s.	d.
To Hills' Bequest for Pot-culture Experiments	9,000	0	0	By 8,126*l.* 8*s.* 2*d.* Consols. at cost .				9,000	0	0
To Fund provided by Sir Walter Gilbey for Endowment of Lectureship at Cambridge until July 31, 1917, when any balance on this account will become the property of the Society	1,016	0	4	By 1,140*l.* Metropolitan Water Board Stock A at cost				998	1	0
				By amount included in the Society's Sundry Creditors' Account:	£	s.	d.			
				Fund uninvested .	1	19	0			
				Income over expenditure. . . .	16	0	4			
								17	19	4
	£10,016	0	4					£10,016	0	4

Examined, audited, and found correct, this 23rd day of February, 1910.

THOMAS McROW, *Secretary.*
WELTON, JONES & CO., *Accountants.*

JONAS M. WEBB,
HUBERT J. GREENWOOD,
NEWELL P. SQUAREY, *Auditors on behalf of the Society.*

Dr. BALANCE-SHEET,

Corresponding figures for 1908.		£ s. d.	£ s. d.	£ s. d.
£	To SUNDRY CREDITORS—			
1,488	Sundry Creditors and outstanding		1,729 4 0	
87	Subscriptions received in 1909 in advance . .		112 7 0	
575	Show Receipts received in 1909 and belonging to 1910		109 0 1	
2,150				1,950 11 1
	To CAPITAL—			
29,267	As at December 31, 1908 .		43,592 9 8	
	BALANCE FROM SHOW FUND—			
	Contribution from Ordinary Income . .	2,500 0 0		
	Less: Loss on Gloucester Show . . .	326 13 0		
12,554			2,173 7 0	
614	Life Compositions received in 1909		729 10 0	
1,066	Donations towards the Society's Funds (including half of a Legacy of 2,000*l.*). . . .		1,053 11 0	
564	Credit Balance on Ordinary Income and Expenditure Account		595 18 4	
44,065			48,144 16 0	
	DEPRECIATIONS written off, viz.:—			
36	Fixtures	28 17 6		
196	Furniture	176 10 0		
11	Machinery	9 19 8		
179	Show Plant	163 1 6		
50	Buildings at Woburn . .	50 0 0		
472			428 8 8	
43,593				47,716 7 4
	[*Note.*—For investments other than those shown in this Balance-sheet see Statement of Funds held in Trust, &c., page vii.]			
£45,743				£49,666 18 [illegible]

THOMAS McROW, *Secretary.*
WELTON, JONES & CO., *Accountants.*

DECEMBER 31, 1909. *Cr.*

Corresponding figures for 1908.		£ s. d.	£ s. d.
£ 36,029	By Reserve Fund 47,883*l.* 19*s.* 10*d.* Consols, at cost (average cost 84)		40,400 0 0
	By LEASE OF 16 BEDFORD SQUARE	2,800 0 0	
	Less Amount written off	100 0 0	
2,800			2,700 0 0
	By FIXTURES—		
	Value at December 31, 1908	444 4 6	
	Less Depreciation at 7½ per cent.	28 17 6	
		415 7 0	
	Added during 1909	66 4 6	
444			481 11 6
	By FURNITURE—		
	Value at December 31, 1908	1,765 0 5	
	Less Depreciation at 10 per cent.	176 10 0	
1,765			1,588 10 5
1,500	By PICTURES (500*l.*) and BOOKS (1,000*l.*)		1,500 0 0
	By MACHINERY—		
	Value at December 31, 1908	99 17 3	
	Less Depreciation at 10 per cent.	9 19 8	
100			89 17 7
	By SHOW PLANT—		
	Value at December 31, 1908	1,630 15 1	
	Less Depreciation at 10 per cent.	163 1 6	
1,631			1,467 13 7
	By BUILDINGS FOR POT EXPERIMENTS AT WOBURN—		
	As per Account at December 31, 1908	550 0 0	
	Less Depreciation	50 0 0	
550			500 0 0
604	By SUNDRY DEBTORS		530 12 7
	By CASH AT BANKERS AND IN HAND—		
	Ordinary Account	185 7 5	
	Reserve Fund Account	145 6 11	
	In Hand	77 18 5	
320			408 12 9
£45,743			£49,666 18 5

Examined, audited, and found correct, this 23rd day of February, 1910.

JONAS M. WEBB,
HUBERT J. GREENWOOD, } *Auditors on behalf of the Society.*
NEWELL P. SQUAREY,

STATEMENT OF ORDINARY INCOME

The Expenditure in this account includes not only cash payments.

Income.

Corresponding figures for 1908.		£ s. d.	£ s. d.
£	ANNUAL SUBSCRIPTIONS:—		
873	*Governors*: Subscriptions for 1909	894 5 0	
65	*Members*: Received in 1908, but belonging to 1909	87 2 0	
6,127	Subscriptions for 1909	6,342 14 10	
152	Subscriptions for 1909 (additional)	135 7 0	
62	Subscriptions for previous years	82 0 0	
	LIFE GOVERNORS AND MEMBERS:—		
208	Annual Contributions	165 9 0	
7,487			7,706 17 10
	MISCELLANEOUS:—		
148	Interest on Daily Balances	76 6 11	
554	Income on Investments	939 5 0	
85	Sales of Pamphlets, Diagrams, &c.	58 8 2	
133	Sales of Text Book	146 4 11	
20	Letting of Council and Committee Rooms	23 2 0	
15	Miscellaneous	1 8 5	
			1,244 15 5
955	Rent of 12 Hanover Square	313 10 0	
	Less Rent paid	313 10 0	
£8,442			£8,951 13 3

THOMAS McROW, *Secretary*.
WELTON, JONES & CO., *Accountants*

but all liabilities in connection with the year's transactions.

Expenditure.

Corresponding figures for 1908.				
£	GENERAL ADMINISTRATION:—		£ s. d.	£ s. d.
1,514	Salaries of Official Staff		1,587 0 0	
—	Honorarium to Secretary		100 0 0	
40	Pensions to Officials		40 0 0	
59	Professional Charges:—Auditors' Fees, &c.		108 7 0	
757	Rent, Rates, Taxes, Insurance, and House Expenses		736 18 8	
8	Binding and Purchase of Books		46 2 9	
414	Printing and Stationery		383 7 10	
200	Postage and Telegrams		190 5 9	
70	Carriage of Parcels and Travelling Expenses (including annual visit to Woburn)		59 4 5	
45	Advertising and Miscellaneous Office Expenses (including re-adjusting Library £50)		109 5 6	
3,107				3,360 11 11
	JOURNAL OF THE SOCIETY, VOL. 70:—			
547	Printing, Binding, &c.		545 0 0	
185	Postage, Packing, and Delivery		197 0 0	
150	Editing, Literary Contributions, &c.		245 0 0	
50	Illustrations		68 0 0	
932			1,055 0 0	
		£ s. d.		
82	*Less* Sales (Vol. 69 and earlier)	75 0 0		
250	Advertisements (Vol. 70)	250 0 0	325 0 0	
600				730 0 0
	Extra Cost of Printing Vol. 69 of Journal			80 18 8
	ELEMENTS OF AGRICULTURE:—			
110	Printing and Binding Text Book			94 17 0
49	PAMPHLETS:—			
31	Printing various pamphlets, &c.		51 3 5	
19	Printing Diagrams		6 7 6	
99				57 10 11
	LABORATORY:—			
615	Salaries, Wages, &c.			614 10 1
	OTHER SCIENTIFIC DEPARTMENTS:—			
250	Consulting Botanist's Salary and Expenses		250 0 0	
200	Zoologist's Salary		200 0 0	
200	Grant to Royal Veterinary College		200 0 0	
2	Medals for Proficiency in Cattle Pathology		2 5 6	
25				
677				652 5 6
	EXAMINATION FOR NATIONAL DIPLOMA IN AGRICULTURE:—			
173	Honoraria and Expenses of Examiners		172 10 8	
41	Travelling Expenses of Officials		72 10 2	
27	Hotel Expenses of Examiners and Officials		33 2 9	
45	Printing, Stationery, and Advertising, &c.		22 13 0	
15	Writing Diplomas		10 10 0	
49	Salary for Assistants		49 10 0	
350			360 16 7	
100	*Less* Entry Fees received and Sales of Examination Papers		87 6 8	
250			273 9 11	
125	*Less* Highland and Agricultural Society's Moiety		136 14 11	
125				136 15 0
	EXAMINATION FOR NATIONAL DIPLOMA IN DAIRYING:—			
15	Hire of Premises, &c.		20 9 2	
40	Fees to Examiners		41 1 10	
15	Hotel and Travelling Expenses		18 13 8	
7	Printing and Postage		5 13 0	
77			85 17 8	
32	*Less* Entry Fees received and Sales of Examination Papers		26 8 4	
45				59 9 4
	EXTRA EXPENDITURE:—			
—	Extra Cost of Trials of Hop Plant			68 16 6
2,500	CONTRIBUTION TO SHOW FUND			2,500 0 0
564	CREDIT BALANCE CARRIED TO BALANCE-SHEET			595 18 4
£8,442				£8,951 13 3

Examined, audited, and found correct, this 23rd day of February, 1910.

JONAS M. WEBB,
HUBERT J. GREENWOOD,
NEWELL P. SQUAREY,
} *Auditors on behalf of the Society.*

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	Fees for Entry of Implements :—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock :—			
	By Members :—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
2,807	25 Substituted Entries @ 5*s*.		6 5 0	3,079 15 0
	By Non-Members :—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
634	40 Entries @ 4*l*.		160 0 0	626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	Fees for Entry of Poultry :—			
	By Members :—137 Entries @ 2*s*. 6*d*.		17 2 6	
126	By Non-Members :—617 Entries @ 3*s*. 6*d*.		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue :—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	Miscellaneous Receipts :—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
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4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
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	Catalogue:—			
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1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	Miscellaneous Receipts:—			
515	Amount received from Refreshment Contractors		515 0 0	
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60	Premium for Cloak Room		60 0 0	
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703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies . . .		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
2,807	25 Substituted Entries @ 5*s*.		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
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	FEES FOR ENTRY OF POULTRY:—			
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	OTHER ENTRY FEES:—			
48	Produce			95 8 6
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	CATALOGUE:—			
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58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies . . .		2,274 16 0	
	Do. do. Gloucester Local Committee		1,580 0 0	
4,049				3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
	25 Substituted Entries @ 5*s*.		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
	40 Entries @ 4*l*.		160 0 0	
634				626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	
126				125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
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£17,414	Carried forward			£17,832 8 5

STATEMENT OF RECEIPTS AND EXPEN-

JUNE 22 TO

Receipts.

Correspond-ing figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
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	257 Entries @ 2*l*.		514 0 0	
2,807	25 Substituted Entries @ 5*s*.		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
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634	40 Entries @ 4*l*.		160 0 0	626 0 0
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	Prizes given by Agricultural and Breed Societies . . .		2,274 16 0	
	Do. do. Gloucester Local Committee		1,580 0 0	
4,049				3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
	25 Substituted Entries @ 5*s*.		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
	40 Entries @ 4*l*.		160 0 0	
634				626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	
126				125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	Miscellaneous Receipts:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
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	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
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	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
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	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
2,807	25 Substituted Entries @ 5*s*.		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
634	40 Entries @ 4*l*.		160 0 0	626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
126	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue:—	£ s. d.		
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	Miscellaneous Receipts:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies . . .		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS :—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK :—			
	By Members :—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
2,807	25 Substituted Entries @ 5*s*.		6 5 0	3,079 15 0
	By Non-Members :—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
634	40 Entries @ 4*l*.		160 0 0	626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	FEES FOR ENTRY OF POULTRY :—			
	By Members :—137 Entries @ 2*s*. 6*d*.		17 2 6	
126	By Non-Members :—617 Entries @ 3*s*. 6*d*.		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE :—	£ s. d.		
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1,081				929 3 11
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60	Premium for Cloak Room		60 0 0	
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	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
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28	Horse-shoeing Competitions			39 15 0
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	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
2,807	25 Substituted Entries @ 5*s*.		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
634	40 Entries @ 4*l*.		160 0 0	626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
126	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
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	Prizes given by Agricultural and Breed Societies . . .		2,274 16 0	
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	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
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634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
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	Prizes given by Agricultural and Breed Societies		2,274 16 0	
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	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
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	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
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25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
126	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
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£17,414	Carried forward			£17,832 8 5

STATEMENT OF RECEIPTS AND EXPEN-

JUNE 22 TO

Receipts.

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723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
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	Non-Members' Fees for Entry of Implements		204 0 0	
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	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
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	Non-Members' Fees for Entry of Implements		204 0 0	
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	FEES FOR ENTRY OF POULTRY:—			
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1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
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4	Miscellaneous		2 7 6	
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2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
2,807	25 Substituted Entries @ 5*s*.		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
634	40 Entries @ 4*l*.		160 0 0	626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
126	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—	£ s. d.		
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies . . .		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	Miscellaneous Receipts:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

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	Prizes given by Agricultural and Breed Societies		2,274 16 0	
	Do. do. Gloucester Local Committee		1,580 0 0	
4,049				3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
	25 Substituted Entries @ 5*s.*		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
	40 Entries @ 4*l.*		160 0 0	
634				626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	
126				125 2 0
	OTHER ENTRY FEES:—			
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28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
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STATEMENT OF RECEIPTS AND EXPEN-

JUNE 22 TO

Receipts.

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	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
	25 Substituted Entries @ 5*s*.		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
	40 Entries @ 4*l*.		160 0 0	
634				626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	
126				125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies . . .		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—	£ s. d.		
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	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue:—			
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	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
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634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
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	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
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	Prizes given by Agricultural and Breed Societies	2,274 16 0	
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	Implement Exhibitors' Payments for Shedding	5,813 9 9	
	Non-Members' Fees for Entry of Implements	204 0 0	
	Fees for Entry of "New Implements"	59 0 0	
5,766			6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—		
	By Members:—2,183 Entries @ 1*l.*	2,183 0 0	
	251 Entries @ 30*s.*	376 10 0	
	257 Entries @ 2*l.*	514 0 0	
	25 Substituted Entries @ 5*s.*	6 5 0	
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	By Non-Members:—164 Entries @ 2*l.*	328 0 0	
	46 Entries @ 3*l.*	138 0 0	
	40 Entries @ 4*l.*	160 0 0	
634			626 0 0
25	50 Entries @ 10*s.*		25 0 0
49	286 Entries @ 5*s.*		71 10 0
	FEES FOR ENTRY OF POULTRY:—		
	By Members:—137 Entries @ 2*s.* 6*d.*	17 2 6	
	By Non-Members:—617 Entries @ 3*s.* 6*d.*	107 19 6	
126			125 2 0
	OTHER ENTRY FEES:—		
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	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
2,807	25 Substituted Entries @ 5*s*.		6 5 0	3,079 15 0
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25	50 Entries @ 10*s*.			25 0 0
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	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
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515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	Miscellaneous Receipts:—			
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	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
	25 Substituted Entries @ 5*s.*		6 5 0	
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	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
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634				626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	
126				125 2 0
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STATEMENT OF RECEIPTS AND EXPEN-

JUNE 22 TO

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634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY :—			
	By Members :—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members :—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE :—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements" . . .	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS :—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies . . .		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
2,807	25 Substituted Entries @ 5*s*.		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
634	40 Entries @ 4*l*.		160 0 0	626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
126	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	Miscellaneous Receipts:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
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	Prizes given by Agricultural and Breed Societies . . .		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—	£ s. d.		
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
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STATEMENT OF RECEIPTS AND EXPEN-

JUNE 22 TO

Receipts.

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60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

STATEMENT OF RECEIPTS AND EXPEN-

JUNE 22 TO

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
	25 Substituted Entries @ 5*s*.		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
	40 Entries @ 4*l*.		160 0 0	
634				626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	
126				125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
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4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
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	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
	25 Substituted Entries @ 5*s.*		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
	40 Entries @ 4*l.*		160 0 0	
634				626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	
126				125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
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£17,414	Carried forward			£17,832 8 5

Corresponding figures for 1908. £	Receipts.		£ s. d.	£ s. d.
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	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
	25 Substituted Entries @ 5*s*.		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
	40 Entries @ 4*l*.		160 0 0	
634				626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	
126				125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue:—	£ s. d.		
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
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1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
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	Miscellaneous Receipts:—			
515	Amount received from Refreshment Contractors		515 0 0	
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	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
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STATEMENT OF RECEIPTS AND EXPEN-

JUNE 22 TO

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	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
2,807	25 Substituted Entries @ 5*s*.		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
634	40 Entries @ 4*l*.		160 0 0	626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
126	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
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	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
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	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
	25 Substituted Entries @ 5*s*.		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
	40 Entries @ 4*l*.		160 0 0	
634				626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	
126				125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue:—	£ s. d.		
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements" . . .	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	Miscellaneous Receipts:—			
515	Amount received from Refreshment Contractors . . .		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
	Do. do. Gloucester Local Committee		1,580 0 0	
4,049				3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
	25 Substituted Entries @ 5*s.*		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
	40 Entries @ 4*l.*		160 0 0	
634				626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	
126				125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
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	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
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	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
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634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
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60	Premium for Cloak Room		60 0 0	
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—	Admission to Royal Pavilion		16 12 3	
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4	Miscellaneous		2 7 6	
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2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
	Do. do. Gloucester Local Committee		1,580 0 0	
4,049				3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
	25 Substituted Entries @ 5*s*.		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
	40 Entries @ 4*l*.		160 0 0	
634				626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	
126				125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	Miscellaneous Receipts:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
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	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
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634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
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1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS :—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
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4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

STATEMENT OF RECEIPTS AND EXPEN-

JUNE 22 TO

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
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1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
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703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

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	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
	25 Substituted Entries @ 5*s.*		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
	40 Entries @ 4*l.*		160 0 0	
634				626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	
126				125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £			£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee				2,000 0 0
	Prizes given by Agricultural and Breed Societies			2,274 16 0	
4,049	Do. do. Gloucester Local Committee			1,580 0 0	3,854 16 0
	Fees for Entry of Implements:—				
	Implement Exhibitors' Payments for Shedding			5,813 9 9	
	Non-Members' Fees for Entry of Implements			204 0 0	
5,766	Fees for Entry of "New Implements"			59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—				
	By Members:—2,183 Entries @ 1*l.*			2,183 0 0	
	251 Entries @ 30*s.*			376 10 0	
	257 Entries @ 2*l.*			514 0 0	
2,807	25 Substituted Entries @ 5*s.*			6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*			328 0 0	
	46 Entries @ 3*l.*			138 0 0	
634	40 Entries @ 4*l.*			160 0 0	626 0 0
25	50 Entries @ 10*s.*				25 0 0
49	286 Entries @ 5*s.*				71 10 0
	Fees for Entry of Poultry:—				
	By Members:—137 Entries @ 2*s.* 6*d.*			17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*			107 19 6	125 2 0
	Other Entry Fees:—				
48	Produce				95 8 6
28	Horse-shoeing Competitions				39 15 0
—	Butter-making Competitions				12 15 0
71	Horse-jumping Competitions				82 0 0
27	Farm rize Competitions				93 0 0
	Catalogue:—				
17	Extra Lines for Particulars of Implement Exhibits	19 17 0			
6	Woodcuts of "New Implements"	6 1 3			
296	Advertising in Catalogue	354 12 2			
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3			
723	Sales of Combined Catalogue	533 3 6			
58	Sales of Jumping Programme	26 4 1			
1,121			960 18 3		
40	*Less* Commission on Sales		31 14 4		
1,081					929 3 11
	Miscellaneous Receipts:—				
515	Amount received from Refreshment Contractors			515 0 0	
94	Rent for Railway Offices			91 10 0	
60	Premium for Cloak Room			60 0 0	
30	Rent for Board of Agriculture Pavilion			30 0 0	
—	Admission to Royal Pavilion			16 12 3	
—	Sale of Materials			6 3 6	
4	Miscellaneous			2 7 6	
703					721 13 3
£17,414	Carried forward				£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
	Do. do. Gloucester Local Committee		1,580 0 0	
4,049				3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
	25 Substituted Entries @ 5*s.*		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
	40 Entries @ 4*l.*		160 0 0	
634				626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	
126				125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

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	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
	25 Substituted Entries @ 5*s.*		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
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634				626 0 0
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	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	
126				125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm Prize Competitions			93 0 0
	CATALOGUE:—			
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Receipts.

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703				721 13 3
£17,414	Carried forward			£17,832 8 5

STATEMENT OF RECEIPTS AND EXPEN-
JUNE 22 TO

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
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£17,414	Carried forward			£17,832 8 5

STATEMENT OF RECEIPTS AND EXPEN-

JUNE 22 TO

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	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
2,807	25 Substituted Entries @ 5*s*.		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
634	40 Entries @ 4*l*.		160 0 0	626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
126	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements. . . .		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
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	By Non-Members:—164 Entries @ 2*l*..		328 0 0	
	46 Entries @ 3*l*..		138 0 0	
634	40 Entries @ 4*l*..		160 0 0	626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
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703				721 13 3
£17,414	Carried forward			£17,832 8 5

STATEMENT OF RECEIPTS AND EXPEN-

JUNE 22 TO

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
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	Prizes given by Agricultural and Breed Societies		2,274 16 0	
	Do. do. Gloucester Local Committee		1,580 0 0	
4,049				3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
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	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
	25 Substituted Entries @ 5*s.*		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
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	40 Entries @ 4*l.*		160 0 0	
634				626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
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	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	
126				125 2 0
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40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
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515	Amount received from Refreshment Contractors		515 0 0	
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60	Premium for Cloak Room		60 0 0	
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	Prizes given by Agricultural and Breed Societies		2,274 16 0	
	Do. do. Gloucester Local Committee		1,580 0 0	
4,049				3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
	25 Substituted Entries @ 5*s.*		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
	40 Entries @ 4*l.*		160 0 0	
634				626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	
126				125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	Miscellaneous Receipts:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
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	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
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71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
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1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
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	Prizes given by Agricultural and Breed Societies . . .		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
	25 Substituted Entries @ 5*s*.		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
	40 Entries @ 4*l*.		160 0 0	
634				626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	
126				125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
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1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
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	Miscellaneous Receipts:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
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	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
	25 Substituted Entries @ 5*s.*		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
	40 Entries @ 4*l.*		160 0 0	
634				626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	
126				125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
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	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
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	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
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	Catalogue:—			
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	Miscellaneous Receipts:—			
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703				721 13 3
£17,414	Carried forward			£17,832 8 5

STATEMENT OF RECEIPTS AND EXPEN-

JUNE 22 TO

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
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	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
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	FEES FOR ENTRY OF POULTRY:—			
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	OTHER ENTRY FEES:—			
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	Prizes given by Agricultural and Breed Societies		2,274 16 0	
	Do. do. Gloucester Local Committee		1,580 0 0	
4,049				3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
	25 Substituted Entries @ 5*s.*		6 5 0	
2,807				3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
	40 Entries @ 4*l.*		160 0 0	
634				626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	
126				125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue:—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	Miscellaneous Receipts:—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
2,807	25 Substituted Entries @ 5*s*.		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l*.		328 0 0	
	46 Entries @ 3*l*.		138 0 0	
634	40 Entries @ 4*l*.		160 0 0	626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s*. 6*d*.		17 2 6	
126	By Non-Members:—617 Entries @ 3*s*. 6*d*.		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
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	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE:—	£ s. d.		
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
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40	*Less* Commission on Sales		31 14 4	
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	MISCELLANEOUS RECEIPTS:—			
515	Amount received from Refreshment Contractors		515 0 0	
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	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
	25 Substituted Entries @ 5*s.*		6 5 0	
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	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
	40 Entries @ 4*l.*		160 0 0	
634				626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	
126				125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
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Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
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	Prizes given by Agricultural and Breed Societies		2,274 16 0	
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5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
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	Fees for Entry of Poultry:—			
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	Other Entry Fees:—			
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703				721 13 3
£17,414	Carried forward			£17,832 8 5

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Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
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	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS :—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK :—			
	By Members :—2,183 Entries @ 1*l*.		2,183 0 0	
	251 Entries @ 30*s*.		376 10 0	
	257 Entries @ 2*l*.		514 0 0	
2,807	25 Substituted Entries @ 5*s*.		6 5 0	3,079 15 0
	By Non-Members :—164 Entries @ 2*l*.		328 0 0	
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634	40 Entries @ 4*l*.		160 0 0	626 0 0
25	50 Entries @ 10*s*.			25 0 0
49	286 Entries @ 5*s*.			71 10 0
	FEES FOR ENTRY OF POULTRY :—			
	By Members :—137 Entries @ 2*s*. 6*d*.		17 2 6	
126	By Non-Members :—617 Entries @ 3*s*. 6*d*.		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE :—	£ s. d.		
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	MISCELLANEOUS RECEIPTS :—			
515	Amount received from Refreshment Contractors		515 0 0	
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703				721 13 3
£17,414	Carried forward			£17,832 8 5

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	Prizes given by Agricultural and Breed Societies		2,274 16 0	
	Do. do. Gloucester Local Committee		1,580 0 0	
4,049				3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
	Fees for Entry of "New Implements"		59 0 0	
5,766				6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
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634				626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	
126				125 2 0
	Other Entry Fees:—			
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703				721 13 3
£17,414	Carried forward			£17,832 8 5

STATEMENT OF RECEIPTS AND EXPEN-
JUNE 22 TO

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies . . .		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	FEES FOR ENTRY OF IMPLEMENTS:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	FEES FOR ENTRY OF LIVE STOCK:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
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25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
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	OTHER ENTRY FEES:—			
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48	Produce			95 8 6
28	Horse-shoeing Competitions.			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	CATALOGUE :—			
17	Extra Lines for Particulars of Implement Exhibits	19 17 0		
6	Woodcuts of "New Implements"	6 1 3		
296	Advertising in Catalogue	354 12 2		
21	Sales of Implement Section of Catalogue (including bound copies)	21 0 3		
723	Sales of Combined Catalogue	533 3 6		
58	Sales of Jumping Programme	26 4 1		
1,121			960 18 3	
40	*Less* Commission on Sales		31 14 4	
1,081				929 3 11
	MISCELLANEOUS RECEIPTS :—			
515	Amount received from Refreshment Contractors		515 0 0	
94	Rent for Railway Offices		91 10 0	
60	Premium for Cloak Room		60 0 0	
30	Rent for Board of Agriculture Pavilion		30 0 0	
—	Admission to Royal Pavilion		16 12 3	
—	Sale of Materials		6 3 6	
4	Miscellaneous		2 7 6	
703				721 13 3
£17,414	Carried forward			£17,832 8 5

STATEMENT OF RECEIPTS AND EXPEN-

JUNE 22 TO

Receipts.

Corresponding figures for 1908. £		£ s. d.	£ s. d.	£ s. d.
2,000	Subscription from Gloucester Local Committee			2,000 0 0
	Prizes given by Agricultural and Breed Societies		2,274 16 0	
4,049	Do. do. Gloucester Local Committee		1,580 0 0	3,854 16 0
	Fees for Entry of Implements:—			
	Implement Exhibitors' Payments for Shedding . . .		5,813 9 9	
	Non-Members' Fees for Entry of Implements		204 0 0	
5,766	Fees for Entry of "New Implements"		59 0 0	6,076 9 9
	Fees for Entry of Live Stock:—			
	By Members:—2,183 Entries @ 1*l.*		2,183 0 0	
	251 Entries @ 30*s.*		376 10 0	
	257 Entries @ 2*l.*		514 0 0	
2,807	25 Substituted Entries @ 5*s.*		6 5 0	3,079 15 0
	By Non-Members:—164 Entries @ 2*l.*		328 0 0	
	46 Entries @ 3*l.*		138 0 0	
634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	Fees for Entry of Poultry:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	Other Entry Fees:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
27	Farm rize Competitions			93 0 0
	Catalogue:—			
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	257 Entries @ 2*l.*		514 0 0	
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634	40 Entries @ 4*l.*		160 0 0	626 0 0
25	50 Entries @ 10*s.*			25 0 0
49	286 Entries @ 5*s.*			71 10 0
	FEES FOR ENTRY OF POULTRY:—			
	By Members:—137 Entries @ 2*s.* 6*d.*		17 2 6	
126	By Non-Members:—617 Entries @ 3*s.* 6*d.*		107 19 6	125 2 0
	OTHER ENTRY FEES:—			
48	Produce			95 8 6
28	Horse-shoeing Competitions			39 15 0
—	Butter-making Competitions			12 15 0
71	Horse-jumping Competitions			82 0 0
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